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Built Environment and Well-Being of STEM Women Employed in the Petroleum Sector

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Walden University
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Abstract

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by

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MS, Liberty University, 2012

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Organizational Psychology

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Abstract

Male-dominated occupations have received increased attention concerning the environmental health and retention of its specialized workforce. Research studies on the impact of the environment suggest that ecological and infrastructure conditions of the workplace affect the psychological health and physical well-being of employees across both public and private industries. Presently, in the context of the oil and gas and engineering field, there is a literature gap in exploring whether workplace conditions or adverse circumstances in male-dominated built environments negatively affect the psychological well-being and retention of women employed in Science, Technology, Engineering, and Math (STEM) occupations. For the current qualitative study, an Interpretive Phenomenological Approach (IPA) was used to investigate the lived experiences and mental health outcomes of 16 STEM women. The subjective feedback collected from the semistructured interviews indicated that the environmental conditions impacted the psychological well-being of STEM women. Working from the person-environment fit (P-E fit) theoretical perspective, the study findings revealed that the support-oriented services and self-help mechanism moderated the gendered biases and aesthetics of the masculine-built environment, which helped the participants persist in the STEM fields. Given the gender inequalities and occupational stressors associated with the STEM sector, the positive social change implications of this study are the understanding of how numerical representation and organizational support can improve the psychological wellness and human capital retention of talented STEM women working in male-dominated built environments.

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Dedication

This dissertation, entitled “Built Environment and Well-Being of STEM Women Employed in the Petroleum Sector,” is dedicated to Ms. Joy Halton. Joy has served as my mentor throughout this academic journey from the embryonic stage of development, thus making it possible to remain steadfast in completing this research study. As a mentor, Joy took great pleasure in discussing the critical tenets of determination, thus becoming a pillar in the community, inspiring others, and maintaining a steadfast commitment toward achieving a real purpose in life. With tremendous respect, I want to thank Ms. Halton for her consistent support.

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Chapter 1: Introduction to the Study

Introduction

In this study, I explored the mental health effects of the built environment on the well-being and retention of professional women across age, employed in male-dominated careers such as the physical sciences, technology, oil and gas field (O & G), engineering, administration, and the math-related workforce. In general, although the representation of women in the science, technology engineering, and math (STEM) workforce and collegiate pipeline has increased throughout the years, they still remain disproportionately underrepresented compared to men across age and ethnicity in all the STEM related domains (Yanosek et al., 2019).

Some studies indicate that the inequitable gender-based differences are acutely higher in the O & G upstream and downstream STEM fields than in any other built environment (Rick et al., 2017; Williams et al., 2014). These differences are particularly evident regarding the number of women that leave the profession mid-career after age 30 (Glass et al., 2013). They tend to be overlooked for promotions for leadership positions (glass ceiling effect; Williams et al., 2014), experience implicit and explicit gender biases and social isolation (Osborn & Kleiner, 2005) and are paid lower occupational wages in comparison to their male counterpart (DiPrete & Buchmann, 2013).

Concerning the built environment, which is described by Dearry (2004) as the material, spatial, cultural, and social activities of human labor, the positive influences linked to the physical characteristics and supportive ecological conditions of the workplace are associated with optimizing or improving the mental and physical wellness (e.g., physical, mental, and interpersonal social outcomes) and job satisfaction of employees (McCay et al., 2017; Simon & Amarakoon, 2015). Previous findings by environmental researchers, such as Wells et al., (2010) and Chenoweth (2015), demonstrated that specific elements associated with the built environment, such as ambient conditions related to ceiling height, spatial dimensions, lighting, thermal heating of buildings, and social interactions, can either positively or negatively impact an employee's sense of well-being and public health perception, which affects one's overall work experience.

For example, experiencing a sense of personal satisfaction with indoor lighting, nearby viewing of sunlight, functional comfort with sitting for extended periods, spatial workspace layout, and floor plan arrangement are positively correlated with improved workplace mood, productivity, and employee cognitive performance (Agarwal, 2018; An et al., 2016; Heathfield, 2019; Weir, 2013; Wells et al., 2010). In contrast, the physical and environmental characteristics of the workplace setting that hinder employees' sense of collective well-being and cognitive functioning are associated with limited access to viewing nature, adverse indoor air quality, unappealing physical space, and poor dimensionality of the designated workspace (Sakallaris et al., 2015).

Moreover, the use of distinct interior design colors (e.g., yellow, orange, red, and blue) in the built environment has also drawn research attention in relation to how combined colors at work can positively alter one's mood or influence unwanted psychological behavior (McCay et al., 2017; Veitch, 2011). The benefit of exposure to specific indoor therapeutic colors in the office setting is believed to have a positive effect on employee mental health functioning, which can reduce adverse physical or mental distress and support improved cognitive productivity outcomes (Connellan et al., 2013;

Gensler, 2013; Mehta & Zhu, 2009). Thus, by understanding the mental health benefits and the interplay between employee productivity and the aesthetics and ergonomics of the built environment, employers can strategically redesign or enhance the masculine oriented workplace setting to improve the psychosocial and mental well-being of staff members (Gensler, 2013b; Iyendo et al., 2016).

In this regard, the petroleum and O & G sector, which is historically male-centric, has recently focused on the prospective good design to help sustain talented STEM employees, especially the increasing number of women in petroleum and O & G field careers (Knoll Workplace Research, 2015). However, presently there are limited studies in the research literature on the retention and effects related to the conditions of the built environment on the well-being of STEM women employed in the petroleum sector and other core STEM fields (e.g., chemistry, physical sciences, engineering, technology; Fouad et al., 2017). Therefore, the purpose of the current qualitative research study was to explore how the built environment of the historically masculine culture of the O & G field (i.e., office positions, drilling rig services, engineering, supplies, distribution, exploration, and production units) and other STEM fields have impacted the retention and mental and physical well-being of women, who are understudied in the growing body of research on women employed in core STEM occupations (White & Massiha, 2016).

The contribution of this study is that I addressed the literature gap on the mental health concerns that adversely affect STEM women employed in the petroleum sector-built environment and other science related fields. Additionally, I continued the discourse on the gendered culture of different STEM fields that tend to push women out (Settles, 2014). Given the importance of the STEM field, this research study may simultaneously further or expand the understanding of the benefits of positive health functioning and help develop effective retention strategies that may mitigate the attrition of professional women employed in STEM careers (Carnegie Mellon University, 2016).

Chapter 1 began with a brief discourse on the background of the problem. In this chapter, I provided an overview of the problem statement, the purpose of the study, research questions and subquestions, theoretical framework, the nature of the study, including the research approach and description of the targeted study participants, key definitions, researcher assumptions, and the limitations and significance of the study. The first chapter then concludes with an overview.

Background

Currently, there is a gap in the literature on workplace stress concerning the psychological well-being of women employed in historically male-dominated STEM fields. This is viewed as troublesome because women account for 47% of the total U.S. workforce and represent only 25% of employees in STEM fields (White & Massiha, 2016). Furthermore, in high-stress work environments, women are more likely than men to experience depression, anxiety, and occupational burnout (Ricard, 2018). Throughout the years, the number of individuals experiencing mental health issues linked to long-term occupational stress and job dissatisfaction has significantly increased across diverse employment sectors (Gensler, 2016). Notably, prior research on the perception of stressful and bias workplace experiences relative to the wellness of women and underrepresented minorities (URM) employed in STEM occupations, demonstrated that there is a strong correlation between low job satisfaction and high employee turnover (e.g., Catalyst, 2018; Cech & Blair, 2010; Smeding, 2012; Vitores & Gil-Juárez 2016; Williams, 2019).

When compared to their White male counterparts, who are viewed as the status quo in STEM industries, workplace factors such as adverse indoor and outdoor environmental concerns, lack of mental health support, absence of mentoring, gender and racial bias, and limited upper management promotions, represent some of the experiences that negatively impact the retainment and psychological health of underrepresented STEM professionals (Myers et al., 2019; Phume & Bosch, 2014; Seron et al., 2018; U.S. Department of Labor, 2018). For instance, Rick et al. (2017b) explored the inequitable context of the STEM work environment and reported that although women start in the same position as men and have similar STEM educational backgrounds and credentials, they are less likely to be promoted to middle or executive leadership positions due to the hierarchal male-dominated workplace.

Consequently, as noted by Glass et al. (2013) and Williams et al. (2012), this can diminish a person's self-confidence and commitment to continue in the occupation or with an organization. Given this experience, individuals are more likely to leave their position despite receiving higher earnings in comparison to non-STEM careers and having specialized training and work experiences in the STEM field (Leuze & Strauss, 2016). In contrast, men receive mentoring and are encouraged to remain in the STEM field long-term to achieve success in the career pipeline (Britton, 2017). Therefore, this tends to suggest that the distinct male-in-group structure of the STEM-built environment mainly supports the psychological wellness of men as opposed to women in the field (Piatek-Jimenez et al., 2018).

Since the end of the U.S. oil bust in the 1980s, which resulted in massive layoffs and subsequently the 2009 economic downturn, the talent shortages of STEM professionals, particularly women and underrepresented groups, have raised concerns about the nations ability to “sustain long-term growth and innovative scientific competitiveness” (U.S. Chamber of Commerce, 2015, p. 8). Consistent with this perspective, the National Science Board (2015) posits that “building the STEM workforce is critical to innovation, competitiveness, and the 21st-century workforce” (p. 9). As such, the National Science Foundation (2017) reported that women represent 50% of college enrollment, 35% of STEM baccalaureate degrees, 47% of the total workforce, and less than one-quarter of STEM occupations (life and physical sciences, computer science, math, and engineering), with the exception of the biological or life sciences research professions. The research also revealed that “minority women comprise fewer than 1 in 10 scientists and engineers” (White & Massiha, 2016, p. 1). The research on the widening diversity gap in the STEM discipline noted that women, African Americans, Latinos, and American Indians/and Alaska Natives are underrepresented in academia for bachelor’s degree attainment, and Asians and White men are overrepresented across all the sciences and engineering disciplines (Catalyst, 2019; National Science Board, 2012). To this end, Wilson (2014) reported that the current inequitable gender and ethnic/race hiring patterns had produced a U.S. labor shortage in the sciences and engineering fields, which threatens the future pipeline needed to sustain companies' diversity goals and bottom-line economic growth.

To increase the number of STEM undergraduates and allied professionals in the future, the physical environment and interactive workplace culture must profoundly change to improve the recruitment and retention of talented and diverse human capital entering the engineering and technical academic pipeline and workforce (Beam, 2016; Roscigno et al., 2012; The White House, 2007). Numerous studies conducted on the mental health and well-being of employees have demonstrated that deteriorating psychological and physical health outcomes can influence physical illnesses, substance abuse, and family problems regardless of their occupational classification as employees in the American workforce (Ganster & Rosen, 2013; Kamarulzaman et al., 2011) .

This belief is consistent with studies on occupational health that have highlighted the connection between work-related distress and negative life events on employee's physical and psychological health (American Psychological Association, 2015; Dias et al., 2016; Ganster & Rosen, 2013). Thus, by failing to acknowledge and address the harmful work-related influences affecting employees' overall well-being, employers raise the possibility for higher healthcare budgets, frequent employee turnover, lower productivity, higher absenteeism, and higher risks of work-related injuries due to lack of focus or concentration inside the work environment (Chan & Huak, 2004; Patel, 2013).

In the case of employee productivity in STEM work environments, studies have suggested that if organizations addressed the adverse trajectories associated with the gendered STEM organizational environment, the high attrition of women might decrease and make the field more gender-balanced (see Avey et al., 2009; Dias et al., 2016; Ganster & Perrewe, 2011; Idris et al., 2014). The retention of STEM women employed in core STEM professions continues to be a major concern for researchers studying male-dominated industries (Buse et al., 2013; William et al., 2014); therefore, the main purpose of this investigative study was to explore the physical and environmental conditions that affect the mental well-being and retention of STEM women employed in the petroleum and O & G field and other STEM fields.

Problem Statement

According to Acker (1990) and The Advocates for Human Rights (2019), the underpinning of gender inequality in the petroleum industry is closely linked to the male-dominated hierarchal social structure and the individualistic culture of STEM-built environments. Although women account for 47% of the total U.S. workforce, they represent less than 25% of employees in the STEM field. Nationally, this is viewed as noteworthy, given the national importance of the STEM field (White & Massiha, 2016). Various industry studies on the relationship between the built environment and mental health suggest that the workplace affects the psychological outcomes of employees across various business and government industries (see Bronkhorst et al., 2015; Evans, 2003; Gensler, 2013a). Moreover, the aesthetics of the workspace can either positively or negatively affect the overall health, personal effectiveness, job satisfaction, and long-term productivity of employees (Kasperczyk, 2011; Taylor, 2011; Veitch, 2011).

Characteristically, within the organizational context, the built environment is described as the physical aspects of various settings (i.e., where people live, work, and socially interact) that are constructed by humans (Evans, 2003). Considering the number of critical hours that a person spends in the workforce throughout their adult life (an estimated 90,000 working hours), the perceived quality issues and exposure to mental health stressors may determine employees' individual wellness outcomes (Mental Health America, 2015; Taylor, 2011). Empirical research suggests that it is important for organizations, especially male-dominated workplace environments, to understand what promotes job satisfaction inside the physical workplace, building environment, and personal workspace for employees (Centers for Disease Control and Prevention, 2016; Parry & Sherman, 2015; Pryce-Jones, 2010; Veitch, 2011).

Recent research on employee health in the workplace has demonstrated that when the workplace environment, affective conditions (i.e., where work is performed), and spatial surroundings are not perceived as conducive or acceptable to one's visual and psychological well-being, this can lead to physical and mental health distress (Firdaus, 2017). As such, persistent factors associated with mental health wellness, gender discrimination, lack of promotions, and personal satisfaction within a masculine workplace culture are some of the key factors attributed to the continuous gender leak in the STEM pipeline, which requires further field investigation (Catalyst, 2018; Xue & Larson, 2015). The metaphor used to describe the unintended gender gap is referred to as the *leaky pipeline*. It is conceptualized as the different intersecting points in the pipeline that loses women starting at the undergraduate collegiate level to professional women leaving or intending to quit the STEM field or occupation prematurely (Lykkegaard & Ulriksen, 2019).

However, in a review of previous literature on the petroleum and O & G built environment and male-dominated workforce, many of the research studies were gender-neutral in the context of examining environmental factors that negatively affect STEM employees in general (Myers et al., 2019). These studies focused more on specific mental and physical workplace stressors that negatively impacted the performance and tenure of both men and women in STEM occupations and failed to examine how the social and physical conditions of the built-environment are perceived by STEM women (White & Massiha, 2016; Vitores & Gil-Juarez, 2016).

Thus, despite the increase of women entrants into historically male-dominated occupational domains, there remains a paucity of studies that explore the lower retention factors and workplace issues that either hinder or propel STEM women in the built environment to continue their employment in this field (Catalyst, 2018; Myers et al., 2019). Klugman et al. (2014) stated that the continued gender inequality in STEM fields is associated with the lack of research studies addressing the turnover and cultural challenges experienced by women in the science and technology fields. More specifically, the recent inquiry conducted by Austin (2018), on the lived experiences of STEM women working in the O & G industry, asserted that additional research is needed to explore aspects of the psychosocial environment that affects the mental health, well-being, and retention of STEM women employed in onshore and offshore positions (Myers et al., 2019).

Klugman et al. (2014) also noted that the discourse from the perspective of women on the challenges of working in the O & G male-dominated built environment (i.e., the physical and social environmental conditions and spatial layout arrangements) is sparse in comparison to research on the well-being of male workers, thus creating a gap in the literature (Austin, 2018; Heathfield, 2019; Williams et al., 2014). Judson et al. (2019), in a recent study grounded in the experiences of STEM women teaching in higher education, pointed out that future studies are needed to assess the experiences and identify the challenges of STEM women underrepresented in other male-dominated fields.

Purpose of the Study

The purpose of this qualitative study was to explore the O & G and other STEM ecological and built environmental conditions that negatively impact the retention and physical, mental, and social well-being of STEM women employed in the male-dominated STEM sector. For this study, I identified the perceived occupational stressors connected to the workplace structural design, culture, and environmental demands placed upon STEM women who are less studied in the case of hegemonic male-dominated industries (Williams et al., 2014). As pointed out by Fairbrother and Warn (2003), this is a critical issue because occupational stress impacts productivity, personal relationships and is connected to "impaired individual functioning in the workplace" (p. 9).

The present study, qualitatively investigated the implicit and explicit perceptions connected to the workplace environment and its link to physiological occupational stress behaviors and well-being experienced among women in STEM. Although the built environment has been contextually studied from many different perspectives and domains, the influences, and aspects of particulary the petroleum and O & G built environment pertaining to women's mental well-being have not been explored in-depth (Austin, 2018). As such, I explored the physical and environmental factors such as exposure to nature, social support, workspace, interpersonal communication, job satisfaction, and sense of inclusiveness in the built environment through the person-environment fit theoretical lens. This theoy was used to better understand how to improve the recruitment and retention of women in core STEM occupations and in the O & G career field (NSF, 2017).

Research Questions and Subquestions

Based on the review of the literature and my professional background as a former employee in the oil and gas industry, the two central research questions and four subquestions that I addressed in this interpretative phenomenological study were:

Research Question 1 (RQ1): How do STEM women describe their work experience in the oil and gas-built environment or other related STEM settings, and how do these perceived experiences affect their physical, mental, and social well-being in the STEM industry?

Subquestion 1 ($SQ_1 1$):What are the perceived daily challenges experienced by women working in the oil and gas workplace environment or other STEM fields?

Subquestion 2 ($SQ_2 1$): Do the design characteristics of the workplace-built environment affect their behavior, mood, or mental health?

Research Question 2 (RQ2): What strategies do women employed in the oil and gas industry or other STEM fields use to manage occupational stress related to the ecological environment of the oil field worksite or corporate office setting?

Subquestion 1 ($SQ_1 2$): What work situations do women perceive as stressful regarding the oil field drilling site or other male-dominated STEM fields?

Subquestion 2 ($SQ_2 2$) What professional services or helping resources are available to employees in the organization to help reduce self-perceived stress or anxiety?

Theoretical Framework

I employed a qualitative method with an interactional psychology perspective to explore the impact of the built environment on the well-being of STEM women. In the context of the O & G workplace environment and other vocational STEM areas, I used the person-environment fit theory (P-E Fit) to help answer the research questions and sub-questions on the physiological and emotional stressor-strain experiences within the STEM-built environment and the supportive services available in the workplace. From an organizational perspective, P-E Fit is defined as "the congruence, match, or similarity between the person and environment" (Edwards, 2008, p. 168). Researchers have found that employees are directly affected by the physical and social characteristics and the spatial conditions inside the workplace, which can lead to complex physical health problems or psychological distress if there is perceived incongruence (Dias et al., 2016; Van Vianen, 2000).

In general, if employers are going to effectively recruit and retain talented, competent, and healthy employees and prevent high turnover, they must develop a healthy work environment to prevent and reduce occupational stress experienced by personnel (Vainio, 2015; Van Vianen, 2000). For the petroleum and O & G industry and other STEM fields, understanding P-E Fit is critical due to the unique technical and scientific setting and health and safety concerns linked in particular to biohazardous exposure, rotating shift schedules, long work hours, and mental health burnout. With women accounting for less than 25% of the employees in the O & G field, it is essential to understand, what are the perceived compatibility views connected to the organizational culture and individual expectations of women in STEM work environments.

This P-E Fit theoretical model is frequently used in organizational psychology and presumes that the organizational fit between individual differences and the environment is strained when there is a discrepancy between the two elements (Edwards et al.,1998; Mackey et al., 2016). Therefore, individuals tend to seek work in environments that likely correspond with their personality, vocational needs and aligns with their subjective organizational expectations (Kristof-Brown & Guay, 2011; Miller, 2014; Walsh et al., 2000). Furthermore, Oh et al. (2014) noted that individuals that have a high sense of P-E Fit demonstrate a better work attitude, experience lower stress, are less isolated from colleagues, and feel more secure in the workplace environment.

As the literature suggests (see Kasperczyk, 2011; Williams, 2019), by understanding distinct P-E Fit needs and the wellness challenges from a subjective lens regarding women in the STEM built environment, companies may be able to create good working environments that foster positive experiences that are psychologically beneficial for all employees. Given the understanding of how the characteristics of the work environment affect the mental well-being of workers, further discussion of the P-E fit theory is included in Chapter 2, which is the literature review section.

Nature of the Study

For this investigative study, my primary objective was to capture first-hand narrative data through interviewing study participants face-to-face and documenting observational behaviors using a qualitative approach. The interpretive phenomenological approach (IPA), was used to explore the mental, physical, and social well-being of STEM women employed in the O & G industry or other STEM fields. The interpretative phenomenological research design is an inherently participant-oriented method, whereby the benefits of the findings increase because researchers establish a closer relationship or bond with the study participants (Merriam, 1998, 2009).

According to Merriam (1998), a phenomenological approach is a research methodology historically rooted in various domains connected to anthropology, history, psychology, and sociology. Flyvbjery (2007) posited that the phenomenological approach is frequently used by researchers for exploratory purposes to objectively understand the lived experiences of study participants. I recruited the participants for the current study on the well-being of women in STEM using a convenience selection and snowball sampling approach as the outreach methods. I employed these methods to purposively identify potential respondents that are STEM women working in the petroleum industry or other male-dominated fields.

Once participants completed the informed consent form, semistructured interviews were conducted, which included collecting personal demographic profile information, reviewing relevant documents, and taking hand-written observational field notes during the open-ended interview sessions. Next, NVivo data analysis software and SurveyMonkey data analysis tools were used to help with the coding and theming of the primary sources of data and supporting data to develop an understanding of the phenomenon or lived experience within the context of the natural workplace environment or work setting (Creswell, 2013).

Since the researcher has professional work experience in the petroleum and O & G sector, the interpretative phenomenological analysis approach was appropriate for the current study on the well-being of STEM women. It allowed the researcher to easily interpret the interview data and relevant documents that represent the respondent's viewpoints, beliefs, and feelings on their lived experiences in the STEM-built environment (Larkin et al., 2006; Smith et al., 2009).

Key Definitions

Bracketing: Describes the process of the researcher identifying any preconceptions or assumptions based on their experiences on the subject matter, which can result in the inaccuracy of the findings and interpretation of the results (Fisher, 2009). In practice, for the sake of viewing data freshly, these involvements are placed in "brackets" and "shelved for the time being as much as is possible." (Fisher, 2009, p. 583)

Built-Environment: Refers to the material, spatial, and cultural activities of human labor, which include places in which people live, work, play, and socialize with each other (Dearry, 2004). Additionally, it represents workplace quality, eco-friendly green space, and the built infrastructure and environment that directly or indirectly shapes one's mental health experiences (Center for Build Environment, 2012).

Core STEM: The STEM acronym is used to describe the core sciences that represent physical and life sciences, technology, engineering, and the mathematics academic discipline (Rick et al., 2017b).

Downstream: The downstream industry includes the oil refineries, petrochemical plants, petroleum products distributors, retail outlets, and natural gas distribution companies that provide thousands of products such as gasoline, diesel, jet fuel, heating oil, asphalt, lubricants, synthetic rubber, plastics, fertilizers, antifreeze, pesticides, pharmaceuticals, natural gas, and propane (U.S. Energy and Employment Report, 2019.).

Ecological: The study of relationships between living organisms, including human beings, and their physical environment. It seeks to explore the existing relationships between plants, animals, and the living environment (Merriam-Webster, n.d.).

Man Camp: Employee housing and living arrangements for the O & G drilling worksite (Clark, 2018).

Offshore Oil Drilling: This is defined as a mechanical process where a drilling bit is used to make a wellbore (hole in the ground) below the ocean seabed to explore and extract oil and natural gas from the earth (U.S. Energy and Employment Report, 2019).

Onshore Oil Drilling: This is defined as a method of drilling deep holes under the earth's surface to explore and extract oil and natural gas from the earth (U.S. Energy and Employment Report, 2019).

Petroleum: From a technical perspective, petroleum is defined as a naturally occurring mixture made of hydrocarbons in a gaseous, liquid, or solid phase. Although it excludes coal, it includes both crude oil and different forms of gas (Petroleum Services Association of Canada, n.d.).

Productivity: Refers to an "economic measure of the efficiency of production, a calculation of the ratio of the economic inputs to outputs" (Center for the Built Environment, 2012, p. 3).

Sex-Segregation: Refers to the division of employee groups using gender as a sorting mechanism to determine their normative job role or occupation (Acker, 1990).

STEM: This is broadly used to defined individuals educated in the biological sciences, biomedical research, engineering, math, technology, and computer science (U.S. Department of Labor, 2012).

Underrepresented Minorities (URM): The National Science Foundation (2017) refers to Blacks/or African Americans, Hispanics, American Indians, and Alaskan Natives as URMs in the STEM field.

Upstream: The upstream industry is responsible for finding and producing crude oil and natural gas. Upstream is also considered the exploration and production (E & P) sector of the petroleum industry (Petroleum Services Association of Canada, n.d.).

Work-Life Balance (WLB): Refers to the management of one's career and other responsibilities connected to family life and personal interests. Employees that achieve a work-life balance feel a sense of ownership of their time and thereby experience less work-related stress (Rautenbach, 2015).

Assumptions, Limitations, and Delimitations and Scope

The main assumptions, scope and delimitations, and limitations of the study are discussed below.

Assumptions

The first assumption was that STEM women would agree to participate in the research study and share their perspectives on the male-dominated workplace environment. Second, that they would openly share their personal and professional beliefs and experiences regarding the male-dominated STEM workplace environment.

Scope and Delimitations

To address the literature gap, the scope of this qualitative study focused on the lived experiences of STEM women in terms of their well-being as employees in the petroleum and O & G industry or another STEM field. The delimitations of this qualitative study were that the study sample had 16 female participants due to the small pool of representative STEM women employed in male-dominated fields. Although Guest et al. (2006) suggested that an acceptable sample size of 15 or higher is adequate, due to the relatively small number of STEM women employed in different work roles, including leadership positions, this research study had 16 women participate in virtual interviews and telephone conference calls. To address the delimitation and recruit an adequate representative sample of respondents the online virtual interviews and telephone conference calls were offered to every participant. Another delimitation was that the data was explicitly derived from a female-only research sample employed in O & G and other STEM-related careers; thus, males were excluded from the gendered study.

Limitations

Limitations are described as potential weaknesses or shortcomings connected to the validity of a research study (Patton, 2002, 2014). For this qualitative study, the first limitation is connected to the use of women as the research population. Selecting women as the targeted sample was due to their low representation in the STEM workforce, which is why recruiting a single-gender female sample was problematic. To address this particular limitation and secure an adequate sample size of study participants, additional outreach techniques, such as expanding the recruitment net of women employed in different states through a national organization of women working in core STEM fields and using snowball sampling as an outreach technique.

The second limitation is that the findings may reflect the personal and professional gendered views as they relate to women working in the sciences and technology-built environment, which can limit the transferability and generalizability of the results to other occupational STEM fields and men working in STEM careers. The third and last limitation was related to having certain beliefs and similar experiences regarding the culture of the O & G industry or another core STEM field as a result of the under-representation of women employed in the STEM sector.

Significance

This research study used a qualitative method to focus on the effects of the built and ecological workplace environment on the well-being and retention of STEM women working in the O & G and other STEM industries. There are several implications found in the study that may contribute to the present literature on the recruitment and retention of STEM women and identify adverse environmental factors, employee policies, and workplace conditions that may cause gendered-related stress and the attrition of women in the O & G and STEM workforce. First, the study highlighted the type of proactive, holistic workplace HR support programs and self-help resources that are needed to improve social interactions, mental and physical well-being, and job satisfaction of women. Second, the results may inform managers of the negative and positive effects of STEM environmental design. Third, the research findings may lead to important intervention strategies and increased leadership pathways to reduce the attrition (STEM leak) and inequality (STEMism) of women who are under-represented in the male-dominated sector-built environment.

Chapter Summary

There is a growing body of literature on the effects of the built and ecological workplace environment on the well-being of employees, but researchers have dedicated less investigative attention to how the social and physical STEM environment (natural elements, lighting, interpersonal interactions, workspace) impacts the physiological and psychological wellness of STEM women (An et al., 2016).

According to Rick et al. (2017a), women and underrepresented minority groups are an untapped resource that O & G firms should recruit and retain to address the future workforce shortage for STEM professionals. In Chapter 1, I presented an introduction and overview regarding the effects of the built environment on the mental and physical health outcomes of STEM women were provided, and the present-day human capital gender gap was explained as it pertains to hiring and retaining women in core STEM fields, which are recognized as male-dominated career domains.

In the next section, Chapter 2, a synthesis of the research literature was discussed on the well-being of STEM women employed in the O & G and other STEM career fields and provided a review of the theoretical Person-Environment fit framework, indoor-versus-outdoor wellness factors, and health outcomes of STEM women employed in petroleum and O & G occupations in particular. Chapter 3 explained the research methodology, research design, sample recruitment approach, demographic survey and interview protocol, and data analysis procedures for the study. Chapter 4 presented the results and analysis of the qualitative interviews and discussed the implications of the collected interview data derived from the research protocol. The final section, chapter 5, provided a discussion of the results and significance of the study. It also presented conclusions and recommendations related to the recruitment and retention of STEM women.

Chapter 2: Literature Review

Introduction

In this qualitative research study, I investigated how STEM women employed in the petroleum-built environment (e.g., oil field operations, corporate office, drilling rig services, supplies, distribution, exploration, and production) and other STEM fields perceive the physical and mental health experiences and retention efforts of professional women employed in the O & G industry. Presently, in the research literature, women are understudied, although the recruitment and hiring of women has recently increased across various STEM fields, and more women, compared to previous generations, are graduating with STEM-related baccalaureate degrees (Myers et al., 2019).

The purpose of this chapter is to present a comprehensive analysis and synthesis of the literature on the built environment, the theoretical framework, and examine research studies on the O & G STEM workplace, as well as the physical and mental well-being of women working in other male-dominated career fields. To investigate the research problem on the wellness and retention of STEM women in the petroleum and overall STEM workforce, I used relevant source material (e.g., Chen et al., 2016; Suri & Clark, 2009) to explore the social and physical environmental conditions of the built environment and the subjective well-being of STEM women.

Research Literature Strategy

The strategy employed to conduct a thorough analysis, synthesis, and review of the research literature included accessing several academic online databases to procure historical and more recent scholarly journal articles on the gendered domain of the STEM work environment and mental health concerns. Peer-reviewed journal articles were sought that related to women employed in the core and related STEM fields, women in the O & G industry, the effects of the built environment on their mental and physical well-being, and the social-ecological factors that negatively impact the retention of STEM women. Notably, primary online databases and search engines used to develop the literature review were Eric, EBSCOhost, ProQuest, Springer, SAGE Premier, Google Scholar, and Taylor and Francis Open Access. Keyword descriptors and combination phrases pertinent to the literature search included topics and words and phrases related to: *built environment, women in STEM, STEM education, O & G industry, physical well-being, STEM collegiate education, gender retention and turnover in STEM fields, male-dominated career fields, gender inequality,* and *gender stereotypes.*

Much of the literature indicated that there is a lack of information on the mental well-being and retention outcomes linked to the built environment on STEM women employed in the O & G research field. As a result, peer-reviewed journal articles published between 2005 to the present and previous source material published before 2005 were accessed for an in-depth historical study of the background and contemporary literature related to this subject matter.

Person-Environment Fit Theoretical Foundation

The P-E Fit theory is rooted in the work of Frank Parsons's (1909) theoretical tripartite model on vocational matching and selection. Parsons believed that individuals with self-knowledge and contextual work knowledge make better-informed career decisions, which supports the interactional psychology perspective related to understanding individual characteristics and environmental fit (Kristof-Brown, 2015). From a contemporary psychological perspective, Edwards (2008) conceptualized the term fit as “the congruence, match, or similarity between the person and environment” (p. 168). P-E Fit theory predicts that the fit between personality differences and the environment is strained when there is perceived incongruency between the two elements (Edwards et al., 1998; Mackey et al., 2016). In contrast, from a contextualized P-E frame of reference, when there is perceived congruency, employees are likely seeking optimal work environments that positively align with their personality, vocational needs, capabilities, and workplace expectations within a particular setting (Miller, 2014).

P-E Fit theory is conceptualized as a multidimensional model, firmly connected to multiple organizational and worker compatibility theories, such as (a) Murray’s (1938) need-press theory; this asserts that individual behavior is maximized and influenced by the environment, (b) Lewin’s (1951) field theory; this suggests that behavioral inclinations are influenced by interactions in the environment (Seong, Kristol-Brown, Park, Hong, & Shin, 2015), and (c) Myers and Myers (1980) personality trait theory; this takes into account personal interests and suggests that occupational choice is identified by personality preferences and strengths.

In Holland’s (1985) occupational choice and fit model, Holland contends that factors such as social interactions, workplace values, job satisfaction, and task-induced stress occurring inside the workplace strongly determine patterns of vocational compatibility or employee fit. Some research suggests that this may also predict employee retention, meaning a person will remain with an organization if they perceive it as a good fit (Edwards & Cooper, 2013). In examining other types of P-E Fit theories, Edward (1991) postulates that the person-organizational job fit (PO) perspective explains specific knowledge, skills, and abilities needed to match the expectations of job experiences and satisfaction. Furthermore, the PO perspective is viewed as “the congruence between the norms and values of the organization and the values of persons” (Chatman, 1989, p. 339).

Like Myers and Myers’s (1980) personality trait and career match discourse, the PO job fit theory contends that when individual characteristics are considered compatible with the workplace environment, an individual is likely to remain employed longer with an organization due to job satisfaction. From a team-building paradigm, the person-group fit (PG) theory notes that if members of a specific workgroup share similar values, goals, and interpersonal skills, the workgroup will likely experience greater job satisfaction and stronger abilities (Werbel & Gilliland, 1999). Cranny et al. (1992) proposed that job satisfaction is “an effective reaction (emotional) to one’s job, resulting from the incumbent’s comparison of actual outcomes with those that are desired (expected, deserved, and so on)” (p. 1).

P-E Fit Theory and Women in STEM

Given the importance of the topic on the mental and physical well-being of STEM women in the petroleum-built environment and attrition outcomes, this investigative study is grounded in the P-E Fit perspective. In the research literature, the P-E Fit interaction model is a dominant theory linked to interactional and organizational psychology research (Edwards, 2008; Edwards & Cooper, 2013; Kristof-Brown et al., 2005). In the context of the O & G and other STEM work environments, the P-E Fit theory is utilized to explore the physiological and emotional stressor-strain experiences that impact the retention of women employed in the STEM workplace environment.

Edwards and Shipp (2007) suggested that the person-environment match perspective is useful in understanding the indoor and outdoor situational factors that influence job satisfaction, employee engagement, job performance, and employee commitment (retention) to an organization. Prior research has well documented that employees at each level of the hierarchal organizational structure are both directly and indirectly affected by perceived physical characteristics, cultural values, and spatial conditions of the workplace environment (deCooman et al., 2016; Elfenbein & O'Reilly, 2007). Essentially, this may suggest that P-E Fit theorizes that if there is incongruency between individual characteristics and the environment, it can lead to detrimental physical health problems or psychological distress outcomes for employees (Dias et al., 2016; Idris et al., 2014).

Consistent with previous research, this conceptualization of P-E Fit thus emphasizes the importance of organizations creating optimal work environments and meeting the individual needs of diverse employees across age and gender (Edwards, 2008, Kristof-Brown et al., 2005). Related research on employee effectiveness and job fit (see Baumeister & Alghamdi, 2015; deCooman et al., 2016; Stone et al., 2019) has also emphasized addressing stress-related risk factors associated with the built environment and examining intervention HR policies that may help to stabilize the retention and health of older workers near retirement age and new professionals (Ganster, 2013; Kristof-Brown, 2017). With attention focused on retaining professional STEM women, organizations are investing more intervention resources into changing specific workplace designs and occupational pressure conditions to reduce high employee turnover, especially among women in the workplace (Vainio, 2015).

Literature Review

Effects of the Work Environment

There are growing interests in the STEM and behavioral science research community on how corporate policy initiatives and physical office setting, across age, affects an employee's work-life balance, mental health, attitude, and organizational commitment (Evans, 2003; Firdaus, 2017; Ng et al., 2010; Suma & Lesha, 2013). In general, the literature reveals that offering benefits in the form of flexible work schedules, job sharing, childcare assistance, extended family leave, working from home, controlling personal workspace, and compliance with the Federal Family and Medical Leave Act improves employee's workplace satisfaction and work performance (Aries et al., 2010; Families and Work Institute, 2008; Working Mothers, 2008).

As applied to the O & G industry, Clark (2018) examined quantitative and qualitative data and reported that there are concerns over health and safety work conditions. Overall, health injuries and mental health risks were unusually high due to documented occupational and environmental safety issues tied to the unique work climate of the offshore and onshore oil drilling worksites. For example, employees are likely to experience biohazardous exposure, extended and rotating shifts, high workloads, frequent exposure to loud noises, and mental burnout caused by sleep deprivation and occupational stress (Burke et al., 2008; Chen et al., 2018; Clark, 2018).

With women accounting for 25% of all employees working in the petroleum industry, and that figure is slowly increasing, William et al. (2014) noted that in addition to addressing the numerical gender disparity in the field, it is essential to identify the inadequate infrastructure conditions and HR policies that affect their psychological well-being, health, and retention. However, Dupre (2013) and Gains (2017) suggested that the deficit issue goes beyond examining the lack of women employed in the O & G workforce. The occupational stress-strain concerns connected to gender stereotyping, workplace setting, HR resources, and lack of leadership advancement in the male-dominated work culture are some of the factors cited for impacting the hiring, retaining, and well-being of STEM women (Gains, 2017).

On the other hand, some critics note that the numerical comparison between men and women employed in the O & G industry is unpopular for reasons related to differences in experiences. Mainly they argue that women are voluntarily choosing to leave the STEM field because of their poor work experiences and environmental fit issues (Mendick et al., 2017). This point is also emphasized in Schwartz's (1989) earlier organizational study on the stereotypic perceptions concerning women engineers in STEM occupations. He studied women working in STEM and proposed that women did not fit well in nontraditional male-dominated work environments in comparison to their male counterparts. Further, he added that men are considered more compatible with the status quo masculine culture of the science and technology industries, thereby inferring that the male-gendered environment is not necessarily responsible for fostering the negative workplace experiences affecting STEM women.

However, it is reasonable to assume that this ideology is problematic for two primary reasons. First, it suggests that the substantial underrepresentation of women is connected to a personal choice or external factors rather than the conditions of the built environment that push women to leave. Second, in comparison to their male counterpart, Schwartz's research indicates that there is a natural conflict between women in STEM and the environmental norms of the science domain that cannot be changed (Miegroet, 2018). In a recent study involving the underrepresentation of diverse STEM women in tenured academic positions in higher education and turnover (Ceci et al., 2014) attributed the outcome to professional deficits or external responsibilities as possible causes.

Essentially, the researchers concluded that there were no gender-based differences in tenured position and tenure-track opportunities presented to both men and women faculty members and that the institution provided an equitable playing field. They specified that the underrepresentation of STEM women in tenure positions was linked to a deficit in their education, productivity, pretenure experiences, or a personal career choice not to seek a tenured assignment. For these reasons, they were more likely also to experience job dissatisfaction with the institutional climate and voluntarily resign from their position. In summary, Ceci et al. (2014) concluded that the underrepresentation of academic STEM women as full professors was not connected to the contextual environment or structural stereotype biases. Instead, it was largely attributed to a personal choice or professional incompetence.

Examining the 2014 quantitative data (i.e., the recent data available at the time of the Ceci et al. study), Van Miegroet (2018) reported that academic women in higher education STEM disciplines were 25% (compared to 75% male) of the total faculty and only 12% (compared to 88% male) were promoted to full professorships. This reported gender disparity may suggest that universities place a greater value on promoting male faculty members to faculty rank than women scientists (Judson et al., 2019; Sheltzer & Smith, 2014). In another research study conducted by Professor Van Miegroet et al. (2019), she stated that the explanation regarding untenured women not being qualified to advance on the STEM career ladder does not suffice. The tenure and promotion gap between men and women faculty members relates to a broader problem, mainly a systemic institutional pattern of implicit bias that protects gender inequality in academia.

Physical, Mental, and Social Well-Being of Women

In past decades the inattention to the well-being of both women and men working in STEM fields was a typical behavior among companies and organizations, and the focus on creating a healthy workplace environment consisted of mainly addressing individual-level problems such as employee stress and burnout (Williams, 2019; World Health Organization [WHO], 2010). Additionally, there were very few employer-sponsored resources or supportive services that specifically addressed the mental health concerns and workplace bias directed toward women working in male-dominated work environments (Austin, 2019). In the present, however, although the discourse on the physical and mental health of underrepresented women in the STEM workplace has improved, they remain understudied across some scientific businesses and STEM industries (Cell Press, 2019; Williams et al., 2014).

Given the fact that women represent half of the nation's workforce, organizations are demonstrating an interest in recruiting and retaining women and ethnically diverse professionals as part of a talent management HR strategy (Williams et al., 2014). In a study on employee retention, WHO found that workplace amenities benefited and promoted healthy employee behaviors and positive social interactions in the workplace. As a result, companies experienced improved employee performance outcomes and retained the number of women working in core STEM and STEM-related occupations (Rick et al., 2017a). As such, by sustaining a talented group of diverse professional women and influencing improved P-E Fit performance outcomes, companies may improve their competitive reputation, gain worldwide market advantages in the O & G and petrochemical distribution markets, and elevate their projected financial growth in the industry (American Petroleum Institute [API], 2015; Knoll Workplace Research, 2015; Pellegrino et al., 2011).

Conceptual Overview of the Built Environment

The explicit association between human behavior and the influence of the built environment dates back to the mid-nineteenth century (Spencer & Gee, 2009). Winston Churchill (1944) stressed the uniqueness of the built environment by stating that “We shape our buildings, and afterward, our buildings shape us” (n.p). The basic premise of this statement is that the architectural design and physical features of the environment have a contributory impact on one’s behavior and attitude. To date, the growing body of research on the effects of the built environment and ecological conditions of the workplace reveal that environmental factors (infrastructural indoor and outdoor quality) with regard to wellness (physical, mental, and social outcomes) impact the health and mental well-being of employees across age, gender, and ethnicity (McCay et al., 2017; Simon & Amarakoon, 2015; Vischer, 2008).

Wells et al. (2010), leading researchers in environmental problems, suggested that the design of the built environment, which includes noise level, height, dimensions, lighting, air quality, green space, and social interactions, influences individual behavior and public health. For instance, in this context, the relationship between the effects of the built environment and personal satisfaction are linked to indoor lighting, which correlates with improved feelings and cognitive performance (Weir, 2013). Moreover, specific therapeutic colors used in interior design (e.g., yellow, orange, red, and blue) can alter one's mood, emotions, and behavior (McCay et al., 2017) and affect psychological functioning (Connellan et al., 2013; Mehta & Zhu, 2009).

Numerous studies within the past several decades on the physical and social climate of the workplace design have highlighted the importance of developing a quality physical and informal social environment to attract new hires and retain talented millennials in the future workforce (Deas, 2017; Erasmus, Grobler, & Van Niekerk, 2015). To gain a competitive advantage, employers have become more focused on securing talented employees with diverse human capital (new knowledge) to gain a competitive advantage over global rival companies and increase their profitability (Cahill & Sedrak, 2012; Deas, 2017; Erasmus et al., 2015).

Rautenbach (2015) noted that younger employees are transforming the present workforce by demanding more from employers than just high salaries and certain workplace amenities. Rautenbach suggests millennials are equally interested in positive workplace experiences, work-life balance accommodations, workspace aesthetics, flexibility, comfort, and healthy social interactions. When examining quality work-life balance issues (i.e., supportive family-friendly work environments), multiple studies have associated the physical environment and culture of the workplace as having a critical impact on employee health and job satisfaction, productivity, and future retention (Gensler, 2016; International Labor Organization, 2018; Miller, 2010; Transportation Research Board, n.d.).

Weir (2013), in a study on workspace stations and layout within the hospital setting, found that when the environmental design of the user-workspace (i.e., ergonomics of the workstation and private office) and the physical office layout are perceived favorably by employees, individuals experience a positive change in mood or attitude and patient recovery improves. He concluded that the indoor and outdoor features of the built environment (architecture) and ecological conditions of the workplace (internal) fundamentally affect a person's physical, social, and mental well-being (Mogan et al., 2013). On the other hand, if the environment is interpreted as unsatisfactory, it can negatively impact job satisfaction, work performance, productivity, health behavior, creativity, attitude, and long-term organizational commitment (Gray & Birrell, 2014).

Ergonomics of the Office Environment

Much of the literature on the impact of the built environment on employee behavior at work reveals that the ergonomics of the office environment is equally important to the physical and mental wellbeing of workers. The organization ergonomics concept centers on the perceived aesthetics of the actual workspace, ambiance, and design conditions that influence behavior, attitude, and worker efficiency (Cantele & Nonemacher, 2019). In practice, although ergonomics is deemed as a hybrid concept connected to occupational health and safety concerns (Dul & Neuman, 2009), Wilson (2000) described ergonomics as the following.

> The theoretical and fundamental understanding of human behaviors and performance in purposeful interacting socio-technical systems, and the application of that understanding to design of interactions in the context of real settings. This definition is justified in the financial, technical, legal, organizational, social, political, and professional contexts in which ergonomists work. (p. 557)

Kahya (2007) maintains that corporations that invest in ergonomics as a cost-benefit management strategy positively improve employee productivity, absenteeism, employee turnover, morale, and the visual image of the organization's ambiance. This denotes that the basic application of ergonomics in the workplace is participatory and designed to optimize the working conditions and performance of employees (Rethaber, 2011). A previous empirical investigation conducted by Lee (2006) on job satisfaction and work performance, using a population sample of 384 office workers in the manufacturing industry, found that the physical environment of the workplace leads to employee dissatisfaction if the environment is perceived as less than optimal.

In another study focusing on occupant satisfaction with the physical environment and mental well-being, McCoy and Evans (2005) found that prolonged psychological stress within the workplace-built environment resulted in reduced motivation, poor worker performance, and negative social interactions. In the case of gender bias, Settles et al. (2006), in a study on job satisfaction and women, demonstrated that women working in a STEM-related field experienced lower job satisfaction in comparison to their male counterparts due to perceived gender discrimination and sexual harassment.

In the context of the oil industry, a focus group study conducted by the American Petroleum Institute (API; 2016) found that job satisfaction (48%) was the third-highest factor that influenced women to accept employment in the O & G industry, while the first and second significant factors were healthcare benefits (60%) and job security (59%). These factors represented the deepest concerns among women working in the O & G industry. The petroleum industry is a historically male-centric built environment, raises awareness on the importance of the "good design" conditions to improve the health outcomes and retain older experienced employees and millennials in the O & G industry (Knoll Workplace Research, 2015). By understanding the relationship between employee productivity and the aesthetics and ergonomics of the workplace, employers could strategically improve the formal physical design to enhance the mental, social, and job performance of all personnel.

The Built Environment and Employee Wellness

In the present review of the literature, there are a limited number of qualitative and quantitative methodological studies on workplace stress experienced by STEM women employed in male-dominated fields such as the O & G field. Austin (2018), in a report titled “Doubly Invisible: Women Labor in the U.S. Gulf of Mexico Offshore O & G Industry,” attributed this literature gap to a lack of interest in the experiences of STEM women working in the petroleum industry. She suggested that being consciously or unconsciously ignored in the research literature has led to the silencing of the well-being of women from their point of view. Conversely, this is concerning, considering that women are more likely than men to experience gender discrimination, sexual harassment, depression, and work-related anxiety as a result of occupational stress (Ricard, 2018; Settles et al., 2012).

According to Ricard’s (2018) study on STEM and the psychological health of women and men in the workplace, the gender differences showed that 7.2% of women working in the life or physical sciences reported having one experience with depression, whereas just 2.3% of men reported experiences with depression. For women working in engineering and architecture, 11.1% reported experiencing depression, whereas only 3.3% of men stated previous experiences with depression. Overall, researchers across various disciplines in the health and social sciences domain acknowledge that many of the personal challenges linked to occupational stressors in the built environment negatively impact individual productivity, social relationships and are associated with "impaired individual functioning in the workplace" (Fairbrother & Warn, 2003, p. 9).

This indicates that the stressful STEM workplace environment correlated positively with adverse emotional functioning among both women and men, with women self-reporting occupational-related stress in the STEM community (Robinson & Mcllwee, 1991). This is a concern since employment trends relative to the field of petroleum engineering, and other STEM fields delineate improved demographic trends in the number of women awarded petroleum engineering degrees and entering the O & G sector after college (America Petroleum Institute, 2016).

To retain and improve gender equity and future generations of women entering the O & G industry, this warrants that organizations collect and respond to data-driven research on health-related outcomes associated with the mental, social, and physical well-being of mainly women in the built environment; from the office environment to the oil field (Shin, 2016; Zerella et al., 2017).

Built Environment in the Context of Health Outcomes

From a business perspective, considering workforce and employee health, the WHO (1948) presents a foundational definition commonly quoted for health status as "Health is a complete state of physical, mental, and social well-being and not merely the absence of disease" (n.p). This definition may suggest that specific workplace resources and social support should be expected to proactively meet the holistic needs of employees (i.e., mental, physical, social) and create a healthier indoor and outdoor workplace climate (Petery et al., 2015; Zweber et al., 2015). In this instance, if integrated health resources and organizational interventions within the workplace environment are lacking, employees are not likely to experience optimal work productivity or positive well-being outcomes long-term (Wieneke et al., 2019).

For the term “well-being” in the context of the workplace climate, environmental psychologists suggest that there are different perspectives that define the meaning. Typically, the term encompasses multiple ecological components that range from individual to group-level employee satisfaction, social relationships, work relationships, work-life balance, organizational support, and general health (Heathfield, 2019). The occupational health perspective, offered by the American Psychological Association (APA; 2013), describes well-being as a good or satisfactory climatic condition of existence, a state characterized by health, happiness, and prosperity (success and financial security). The World at Work (2012) presents another relevant definition that describes well-being as “the active state of pursuing health and life skills to achieve physical and emotional health and financial security” (n.p).

Note, the latter conceptualization expands the definition and refers to financial security as a critical facet in influencing employee’s well-being and behavior. The third definition suggests that the physical built environment plays a significant role in shaping individual and group employee health and well-being responses. Apart from the economic and social relation factors mentioned in the earlier definitions, research shows that the internal and external environment (architectural features and office design) affect employees' moods at work and the psychosocial environment interactions (Bluyssen, 2014; Marrow et al., 2012; Veitch, 2011). Industry studies linked to the built environment or physical infrastructure suggest that the built environment affects the psychological and physical well-being of employees across various public and private industries (Bronkhorst et al., 2015; Evans, 2003; Gensler, 2013a).

Impact of the Built Environment on Well-Being

During recent years the relationship between the built environment and mental health has been widely studied relative to the reactions (behavioral and attitude) of the general population employed in various workplace domains (Galea et al., 2005; Howden-Chapman et al., 2011; Latkin & Curry, 2003). Based on the aesthetics of the work environment, Veitch (2011) noted that the design characteristics of the office or workspace could either positively or negatively affect the overall health and productivity of employees. Characteristically, in the organizational setting, there are several definitions used to describe the built environment concept formally. The first is a general term and defines the built environment as the physical aspects of various spaces (i.e., where we live, work, socialize, and play) that are built by humans (Evans, 2003).

The second definition refers to the built environment as the physical aspects or characteristics of various structural settings (i.e., where one lives or works) that are constructed by humans. Lastly, the third definition for the built environment is expanded to include ecological office climate and the positive everyday interpersonal interactions occurring within a particular workspace (Dearry, 2004; Evans, 2003). With American workers spending half of their non-sleeping hours in the workplace as paid employees (Hipp et al., 2015), it is argued that organizations benefit when employees experience psychological and visual satisfaction with the physical environment and workspace design (Iyendo et al., 2016; Rethaber, 2011).

Veitch (2011) indicated that individuals who work outside the home environment spend 33% or more of their time in the workplace, which conversely leaves them more vulnerable to mental and physical health concerns (Schill & Chosewood, 2013; Taylor, 2011). Considering the high number of hours spent inside the workplace, which for full-time employees is estimated at 33%, Schweizer et al. (2007) assert it is likely that the quality and conditions of the work environment will impact employees' well-being over time. The International Labor Association (2018), a tripartite organization that advocates for fair work-related policies, conditions, and standards, compared employee work schedules among developed and underdeveloped countries and found that 19.3% of American workers, both men, and women, work more excessive hours annually (i.e., defined as more than 48 working hours a week) in comparison to developed countries.

Conversely, this may suggest that American employees are more likely to experience a higher percentage of mental health discomfort due to the impact of the built environment (indoor and outdoor characteristics) on their physical and emotional wellness (Dearry, 2004). Environmental psychologists have well documented that the varying effects of the built environment and ecological conditions of an organization cost U.S. businesses billions of dollars each year (Maxon, 1999; Schill & Chosewood, 2013). The common occupational stressors associated with causing health and wellness problems (e.g., physical, mental, and social relations) in the workplace can either positively or negatively influence the attitude and satisfaction of employees (McCay et al., 2017; Simon & Amarakoon, 2015).

In a study on the effects of the hospital-built environment, Weir (2013) expressed that when the environmental design and workplace conditions are perceived favorably, the medical staff experienced a positive change in mood or attitude and provided better services to patients, and the patients reported having a better healthcare experience and improved recovery outcomes. By understanding the relationship between employee well-being and the aesthetics and ergonomics of the workplace environment, employers are strategically able to improve the physical health, mental health, and workplace performance of the employees.

Subjective Well-Being and Workplace Ecologies

Subjective Well-Being (SWB) inside the workplace is defined as the evaluation of one's life and effective responses to personal experiences. At the global level, it has become a management priority for employers interested in improving and maintaining employee performance, productivity, and wellness within the organizational setting (Zweber et al., 2015). In the case of the built environment, SWB is formally defined by the Organization for Economic Cooperation and Development (OECD; 2013) standards as "various evaluations, positive or negative that people make of their lives and the affective reactions of people to their experiences (p. 29).

The implication of this conceptualization suggests that negative perceptions of the ecological workplace and health climate can have a causal relationship with employee's perceived well-being. For example, previous research on self-reported employee health has found that limited organizational and social support from co-workers and supervisors is linked to work-related stress, burnout, and lower job satisfaction, which negatively impacts productivity, employee health, and one's sense of well-being (Elovainio et al., 2000; Vogt et al., 2013). With reference to the ecological environment, it should be noted that the organizational health climate is viewed as "employee perceptions of active support from upper management as well as supervisors and coworkers for the physical and psychological well-being of employees" (Zweber et al., 2016, p. 251).

Some organizational research on occupational health and promotion supports the belief that it is the responsibility of corporations to address workplace cultures and environments that negatively affect an employee's physical, emotional, and sense of wellness (Berthelsen et al., 2015). When organizations practice shared leadership or utilize affinity teams as a collaborative management style, they are more likely to explore the innovative workplace designs and climates that encourage healthier lifestyles and attitudes among employees (Kalleberg, 2018). However, there is some debate on whether establishing and sustaining a healthy workplace climate fosters employee wellness and if the employer is solely responsible for changing the physical elements of the organization to fit employee needs (Gravenkemper, 2007). Instead, it is proposed that a shared responsibility, comprised of the leadership (senior and middle-level management) team and employees, are required to make a positive and sustainable difference in the health of the workplace design, culture, and climate (Gravenkemper, 2007).

Workplace Design

Contemporary organizational research on the influence of the built environment (architecture) and workplace ecologies (i.e., the interrelationship between employees and the organization) has consistently suggested that workplace designs and climate affect employee job satisfaction, cognitive performance, productivity, health behavior, absenteeism, creativity, attitude, and organizational commitment (Gray & Birrell, 2014; Thaler et al., 2014). Irrespective of gender and industry, in past decades, the research on mental health outcomes and design was relatively limited or narrow in scope regarding the study on the impact of the infrastructure and aesthetics in the work environment (climate) or office workspace (e.g., condition of the building, number of offices, air quality, number of floors, and furnishing) (Kelloway & Day, 2005; Zweber et al., 2015).

Although limited, one problem with the earlier research (e.g., Cherniss, 1991; Leiter & Schaufeli, 1996) on the topic of wellness and the work environment was that it primarily maintained an individual issue approach and examined one or two medical issues (i.e., stress or burnout) that attributed to mental health problems. The flaw with that evaluative approach is that to assess mental health risks in the workplace, and a multidisciplinary and comprehensive structural approach is needed to fully explore factors such as job satisfaction, well-being, employee productivity, and the overall organizational health climate (Song & Baicker, 2019).

Consistent with this belief, research conducted by the Center for Disease Control and Prevention (2012) in the environmental context (e.g., quality of the environment, mental health, policies, and cultural factors) suggested that the earlier oversight concerning a healthy workforce may be linked to organizations not valuing a *healthy worker framework* when studying workplace designs and conditions. In the petroleum and O & G office work environment, which is traditionally male-centric, firms are becoming more aware of the importance of the purposeful-built "good designs" as an intervention to improving the overall wellness of employees (Knoll Workplace Research, 2015).

More recently, API (2016) projected that the petroleum and O & G industry would add an estimated 1.3 million blue-collar, professional, and management-oriented positions by the year 2030. With the expectation of a high number of retirees in the next decade, professional women and underrepresented groups with field experience in the industry are considered key to filling those vacated positions and addressing the projected employment STEM shortage confronting the industry.

Strategically, for corporations to prepare for the expected retirements in the STEM industries and increase the number of talented new hires, Rick et al. (2017b) highlighted the importance of creating more healthy and inclusive workplace environments that support the positive psychological and physical health of both genders. If strategically implemented, this could, at the same time, reduce the obstacles that heavily impact employee productivity, regular attendance, poor social conditions, and the climate of the workspace.

The STEM Career Workforce

To address the national deficit in the STEM career pipeline, the United States federal government legislatively established the STEM initiative with bi-partisan support (The White House, 2007). During the President Bush administration, the 2007 H.R. 2272 America COMPETES Act (i.e., America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act) was signed into law to establish the Nation’s STEM priorities (The White House, 2007). In 2009, the Obama administration’s President Council of Advisors on Science and Technology reaffirmed the COMPETES Act and created the Innovate to Educate Initiative to establish America’s national STEM goals (1) close the impending STEM workforce gap in scientific research and development, (2) increase STEM education grants and scholarship opportunities, and (3) diversify and bolster the science and technology career pipeline with more women and underrepresented minority groups (The White House, 2007, 2009; Xue & Larson, 2015).

Consequently, to comply with the federal initiative and reduce gender stereotypic beliefs and labor force inequities linked to STEMinism, (i.e., which intersects with sex-segregation and ethnic biases), American businesses and organizations partnered with government agencies, public and private higher education institutions, and STEM non-profit advocacy organizations to increase the recruitment and retention of women in STEM fields as new hires (William et al., 2012; Xue & Larson, 2015). In general, the STEMinism concept (stem-specific-feminism) is derived as a sociological term associated with the historical structural inequities that disadvantage and narrow the number of women working in male-dominated STEM fields (Ceci et al., 2009; Myers et al., 2019).

Conversely, some major and mid-sized companies are engaging in discourse on strengthening the representation of women in STEM careers and focusing on potential strategies to create an inclusive workplace environment (Exharheas, 2017; Powell, Bagilhole, & Dainty, 2009). This may include facilitating formal diversity programs and formal mentoring to reduce the adverse elements of the traditional masculine work culture (Glass et al., 2013; Miller, 2004). Economically, in North American, the STEM workforce is considered vital to the country's national gross domestic product (i.e., economic growth and performance) and its global competitiveness (Fox et al., 2011), which makes this issue of gender disparities even more important to address.

More specifically, from an organizational perspective, STEM is credited with elevating more innovative human capital (creating new knowledge) for society and offering numerous STEM and related STEM career pathways from the area of research and development to engineering (NSF, 2015). According to the Pew Research Center (2018), in the American workplace, there are over 74 STEM occupations and STEM sub-fields that include the computer sciences, life sciences, physical sciences, math, engineering, architecture, health care, and technicians. Furthermore, over 17 million employees are working in STEM-related occupations, which is 13% of the total workforce population, and globally, in the O & G industry, there are 1.34 million employees (Pew Research Center, 2018; see Table 1).

Table 1

Workers in STEM-Related Occupations

STEM Occupation Category	N (In Millions)
All Employed	131.3
STEM employed	17.3
Healthcare practitioners/technicians	9.0 (52%)
Computer Workers	4.4 (25%)
Engineers/Architects	2.7 (16%)
Physical scientists	0.6
Life Scientists	0.3
Mathematical workers	0.2
Non-STEM employed	114.0

Note. Pew Research Center Analysis 2014-2016 Community Survey (Pew Research Center, 2018).

Compared to non-STEM career fields, growth in core STEM occupations has increased since the 1990s in terms of employment opportunities and higher earnings, which are 33% more than non-STEM careers (Leuze & Strauss, 2016; Pew Research Center, 2018). In some of the research on STEM careers, a significant workforce gender gap is noted relative to the number of women employed in core STEM career fields, although they represent virtually half of the college graduates (approximately 51%) and 35% among those that earned a STEM bachelors or advanced degree in American higher education institutions (Beede et al., 2011). Currently, women represent nearly half of the general workforce across different career professions but are less represented in positions of leadership, especially in STEM fields (Carli et al., 2016; Szelenyi & Inkelas, 2011; NSF, 2013).

This invidious practice of gender stereotyping and inequality in hiring women, which negatively impact the employment of women in the sciences overall, is a well-established and documented workforce trend in the male-dominated career fields (Hill, Corbett, & St. Hill, 2010). The United Nations Human Rights Office of High Commission defines gender stereotyping as the,

> The generalized view or preconception about attributes or characteristics, or the roles that are or ought to be possessed by or performed by women and men. A gender stereotype is harmful when it limits women's and men's capacity to develop their abilities, pursue their professional careers, and make choices about their lives. (n.d, para. 2)

This above definition is consistent with the view that gender stereotyping can lead to unconscious and conscious acts of discrimination, which is unlawful under the U.S. Title VII of the Civil Rights Act of 1964, a federal law designed to specifically protect the equal rights of women (Guy, 2003; Guy & Fenley, 2014). The language of this particular act addresses workplace discrimination and "protects employees from being fired, denied admissions to a union or employee group, or generally discriminated against because of race, ethnicity, religion, sex, or national origin" (Guy & Fenley, 2014, p. 45).

Despite the civil protections given under the 1964 civil rights law, which prohibited employment discrimination according to race, gender, color, religion, sex, and national origin, researchers found that women employed in male-dominated fields still experience insensitive workplace conflicts in the work environment. Consequently, relative to unconscious stereotypic beliefs regarding their gender and scientist career identities, STEM women tend to leave STEM occupations mid-career, after age 30 because of gender bias and the isolating work culture evident in male-built environments (Glass et al., 2013; Hewlett et al., 2008; Society of Women Engineers, 2009). From a gendered lens, implicit biases and societal stereotypes may disadvantage women working toward a leadership pathway in STEM (Smeding, 2012). In general, women are often characterized by their male counterpart as incompetent, having a lower mathematics and reasoning aptitude, poor negotiators, unsuccessful managers, and demonstrating an egalitarian style of leading instead of being aggressive, which is associated with traditional male dominate behaviors (Catalyst, 2009; Mast, 2004; Smeding, 2012).

As a result, this may cause some women to mute their gender identity or disassociate themselves from displaying feminine traits inside the workplace environment (Ellemers & Haslam, 2011; Ely, 1995). Powell et al. (2009) characterized the process of feminine suppression of gender identity as the undoing one's gender role for tangible benefits. This, they concluded, influences, or upholds the unequal conditions of the male-dominated workplace environment and may deem it as optimal. For example, Ely's (1995) earlier study on gender segregation and identity in the workplace found that female attorneys working in male-dominated law firms deliberately rejected female identify characteristics and instead demonstrated masculine traits for pursuing career advancement opportunities.

The careers characterized or classified as *male-dominated* fields relate to gendered work-oriented job roles and tasks that society views as either related to masculine careers or having traditional male characteristics (Carli et al., 2016). Those occupations viewed as masculine jobs represented at least 75% of the total workforce (Alfeld et al., 2008; Eccles, 2011). Male-oriented occupations are also associated with having higher payroll earnings, higher professional status, and employee benefit packages (e.g., health insurance, retirement plan, and greater flexibility regarding work accommodations) in comparison to non-stem fields such as education and the social sciences (Gustafson, 2008; Ong et al., 2010).

The traditional occupations identified as masculine-dominated careers included law enforcement, transportation, forestry, engineering, agriculture, and prison corrections (Smith & Monaghan, 2013). While in comparison, female-oriented careers, which are believed to align with stereotypic feminine identity traits, are associated with occupations in the healthcare industry, childcare, teacher education, disability services, environmental sciences, social sciences, and civil rights careers. Historically, fields that are viewed as stereotypic female-oriented job roles are viewed as somewhat undervalued by society and receive lower annual pay in contrast to STEM careers (Leuze & Strauss, 2016).

Based on research by Stanley and Soule (1974) on labor market stereotypes and what constitutes a feminine job (women's work) from a masculine job (men's work) in the workplace, they indicated that "there are two significant distinctions between feminine and masculine careers: (1) the sex ratio of the occupation; the numerical ratio of women to men; and (2) the nature of the work; whether the work role or tasks are consistent with masculine or feminine characteristics, such as attitudes, skills, and values (p. 245). This narrow conceptualization of gender-specific occupations confirms the notion that "feminine women were certainly not expected to participate or excel in men's work" (Lemkau, 1979, p. 222).

An earlier comment purported by Whyte (1956) on the traditional roles in the American workforce and the distinction between job role and career advancement outside the home described the home-work dualism as having "organization men and family women" in the workplace (p. 15). This statement suggests that men are devoted and committed to their employers and supporting their family while working women have the double burden of managing both work and family responsibilities (Alkadry & Nyhan, 2005; Carli et al., 2016; Tower & Alkadry, 2008). Feldman et al. (2004), in a study on career choice and work-life balance, investigated the challenges of working women and reported that married men, who are considered the breadwinners by society, focus on their careers because they have a partner to manage the family responsibilities.

Given their presumed role as financial providers for the family, the men performed fewer responsibilities inside the home and were not expected to make career adjustments to accommodate family responsibilities in contrast, when women join the workforce, they are expected to “adjust to meet the demands of the organization, not the other way around” (Johnson & Duerst-Lahti, 1992, p. 64). Interestingly, Guy (2003) stated that organizations are “workplaces designed for men but inhabited by women” (p. 257). Unfortunately, in the current, this ascribed ideology still permeates the broad workforce, especially in STEM-related career fields (Demantas & Myers, 2015; Fox et al., 2011; Hale, 1996).

Substantively, like women trained and educated in the sciences, underrepresented minority groups with STEM degrees and technical experience (*male and female*) are also treated as invisible in the STEM workforce (Frazier, 2017). Consequently, systemic push factors such as job instability, job insecurity, ethnic and gender discrimination, stereotyping, fewer URM role models, and students leaving the collegiate STEM pipeline are associated with less-than-optimal psychological implications that promote stereotype biases (Bruning et al., 2015; Noonan, 2017; Rice & Alfred, 2014). Accordingly, these critical push factors mentioned above are consistent with other research literature in explaining the low number of qualified professional women and ethnic minorities entering the STEM pipeline and retaining them in the O & G industry long-term (Williams et al., 2014; World Petroleum Council, 2017). The STEM pipeline is described as having "future education, training, and career opportunities which includes attaining a STEM career" to become a STEM professional (NSF, 2015, p. 14).

Table 2 illustrates a comparative summary of the ethnic demographics that make up the number of STEM baccalaureate degrees awarded from 2013 to 2015 by American universities. Also, in the table, the degrees conferred are categorically listed according to race (U.S. Department of Education, 2015).

Table 2

Percentage Distribution of STEM Bachelor Degrees Conferred by Race

Racial Identity	2013-2014	2014-2015
Asian/Pacific Islander	13.1	13.1
White	67.0	65.8
African American	7.2	7.1
Hispanic/Latino	9.5	10.2
Native American/Alaska Native	0.5	0.4
Other/Multi-Racial	2.7	3.3

***Note**:* U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education System (IPEDS), Fall 2013 to Fall 2015. https://nces.ed.gov/programs/digest/d16/tables/dt16.asp

Table 2 shows that the STEM-related degrees issued by race include the biological sciences, engineering, computer science, mathematics, and physical science fields of study. As evident, from the year 2014 to 2015, a higher number of STEM degrees were awarded to White graduates, and the lowest percentage was conferred for African Americans, Native Americans, and multi-racial university graduates. As for gender, relative to the number of science and engineering degrees in 2015-2016, 29%

were awarded to women, and 71% were awarded to men (National Science Board, 2016). These reported outcomes are somewhat disturbing, considering that the STEM workforce is currently facing a talent shortage and has a high demand for STEM professionals in all areas of engineering, software development, and computer engineering (Noonan, 2017).

The NSF (2017) has long researched and documented the annual progress and numerical rates of participation of STEM women and people of color entering STEM academic majors, entry-level positions, and leadership roles in employment and academia. From the STEM participation rates, the NSF reported the stark between-group differences in gender and racial group experiences, which may account for the structural STEM pipeline disparities in core science and engineering disciplines (Settles, 2014; White & Massiha, 2016). Specifically, they summarized the following key points:

- People of color and women continued to be underrepresented.
- Seventy percent of science and engineering employees in 2013 were White males, and that figure has remained steady.
- Latinos, African Americans, Native Americans/Alaska Natives have significantly lower representation in the sciences and engineering workforce (11% combined).
- Asians represented 17% of the science and engineering workforce, which is higher than the other minority groups.
- Diverse women entering science and engineering STEM fields have slowly increased.
- Women of color are 1 out of 10 employed scientists and engineers. (NSF, 2017).

Other researchers suggested that to address the science and technology employment gap, women and underrepresented students are needed to fill the male-dominated workforce occupations across all the STEM fields (Hill et al., 2010; Noonan, 2017). Currently, in the United States, women, and underrepresented minorities (ages 18 to 64) collectively represent half of the American workforce, and the numbers have steadily increased (Hill et al., 2010). In the healthcare field and biological sciences, women are overrepresented in these fields (74.7%), and people of color, except for Asians and Whites, are significantly underrepresented in the fields of engineering, physical science, and computer and information science. In fact, the engineering and engineering technology industries have the fewest number of women entering the field, and computer sciences have the second-lowest number of women studying in the academic major and in the technology pipeline (Corbett & Hill, 2015; NSF, 2013).

STEM Women in Petroleum and Oil and Gas Careers

Globally, among all the STEM-related industries (e.g., engineering, physical science, computer software and information science, healthcare, mathematics, technical fields), the petroleum O & G sector is considered the largest and most influential business enterprise in the world's global economy (Williams, 2019). In North American, the five major O & G and petrochemical companies (e.g., BP, Chevron, Conoco Phillips, Exxon, Mobil, and Shell) earned $93 billion in profits and employed over 1.39 million workers across different professional and allied positions (e.g., management, services, sales, office support, blue-collar, semi-blue-collar employees). Out of this figure, women comprised fewer than 25% of the O & G STEM workforce population (World Petroleum Council, 2017).

Some of the key factors associated with the exclusion and low retention of STEM women in the O & G industry are associated with the masculine images used in print materials, lack of visible female role models in management, high employee turnover, job dissatisfaction, occupational stress, gender stereotyping, lack of HR cross-gender or same-gender mentoring, few leadership pathways, and limited training support (Osborn & Kleiner, 2005; Seron et al., 2018; Wilson, 2014). These factors are described by some as influencing the stereotypical masculine work climate and gender differences regarding the retention of women in the petroleum industry (Gyan, 2013; Smeding et al., 2016; World Petroleum Council, 2017).

A Leak in the STEM Pipeline

The metaphor used to describe the attrition of academic and professional women that leave STEM fields is referred to as the leaky pipeline. This phrase is commonly used in the sciences and technology disciplines to describe women that enter college as a STEM major and later switch their academic major to earn a non-STEM degree or professionals that leave STEM fields after working in the occupation for a short time (Lykkegaard & Ulriksen, 2019). More recently, science research that questioned the continued burgeoning loss of women in the STEM pipeline asserted that past research on the resiliency of the gender leak narrowly framed the scope of the human capital problem regarding STEM (Cannady et al., 2014; Myers et al., 2019); treated the problem as monolithic relative to all women (Victores & Gil-Juarez, 2016); and cultural and contextual reasons thought to produce the leak were not seriously considered when explaining the underrepresentation of women in STEM occupations (Mendick et al., 2017).

Metcalf (2014) suggests that identify markers according to numerical counting should not be the primary issue of the gender inequality discourse with regards to women in STEM careers. Similarly, Cannady et al. (2014) posited that the low female headcount should be de-emphasized and not serve as the distinct focus of the issue. Instead, the unique individual experiences that led to the career decision to leave the STEM field should be investigated across the different industry domains. Myers et al.'s (2019) suggested that the gender leak is a result of traditional systemic structural inequalities in the science and engineering domains. The term used to describe this phenomenon is referred to as STEMinism, which the authors define as "placing the onus on the individual student or scientist to succeed in STEM fields rather than interrogating and removing structural barriers to success" (p. 10).

The structural barriers or push forces that characterize STEMinism are rooted in the concern that women graduating from STEM programs are not prepared to counter-demonstrations of sexism and racism and are not empowered to seek emotional support to confront structural barriers as a feminist (Leaper & Arias, 2011; Seron et al., 2018). Although women have the academic qualifications and education to succeed in the STEM field, they tend to leave the engineering or science fields earlier in comparison to their male counterparts (Piatek-Jimenez et al., 2018).

Notably, this is troublesome since previous studies suggest that a high number of eligible employee retirements are expected in the O & G industry among those over the age of 50 (i.e., baby boomer generation), and there is a shortage of highly trained candidates to replace them (World Petroleum Council, 2017). Currently, the World Petroleum Council reported that the aging population of skilled workers represents three-quarters of the O & G workforce (Rick et al., 2017b). At the same time, the industry is confronted with a complex historical workforce gender imbalance, with women underrepresented in senior and middle-level leadership positions (16%), technical and oil field operations (15%), and traditional business support roles (e.g., finance, legal services, office support; 53%; Rick et al., 2017b).

In comparison to other job industries, the O & G sector offers a higher entry-level salary for recent college graduates but has the second-lowest number of female employees, although there is a need to hire younger and diverse new talent (Exarheas, 2017). For example, in contrast to the oil industry, “women employed in healthcare and social work represent 60%; education, 55%; restaurants and hotels, 43%, finance, 39%, agriculture, 33%, manufacturing, 33%, public administration, 28%, O & G, 22%, and construction industry, 11%” (Rick et al., 2017b, p. 8). Underhill & Freer (2013) indicated that the oil industry is making an effort to understand the reasons for the national shortage of underrepresented minorities and women employed in the petroleum and energy sector to stop the drain of talent in the U.S. labor market.

The U.S. Department of Labor (2018) reported that women employed in petroleum extraction and drilling careers make up 19.1% of the O & G extraction industry. When the labor force demographics are extracted or categorized by race, white women represent 85.5%; Black women represent 5.4%; Asian women represent 8.1%, and Hispanic women represent 17.7% of the O & G workforce industry. Moreover, API (2016) stated that because more women with bachelor’s degrees are drawn to the petroleum sector due to higher salaries, they are predicted to enter the oil industry, and the challenge for most major and mid-size oil companies is retaining them in the demanding industry.

The typical work shift in the oil field is 12 to 16 hours a day due to 24-hour drilling operations, and women, like the men, are expected to lift heavy equipment (80-to-100 pounds) and work in harsh weather conditions and climates, whether onshore or offshore (Clark, 2018). Some corporations, such as the Precision Drilling firm, administers the Roughneck 13-question pre-employment quiz to assess if oil rig drilling fieldwork is a job fit for potential candidates and determine if candidates have the adaptive capabilities to work and live in the oil field man-camp environment (Precision Drilling, n.d.). Williams (2019), studying women working on the Trans-Alaska Pipeline Project, expressed that “women field workers are expected to labor as hard as the men, and in many cases, harder just to keep their jobs” (p. 36). Globally, and in the American O & G industry, the adverse effects of gender inequality are still prevalent; thus, women with equal abilities as men are not receiving job promotions and recognition awards for performing the same work as their male counterparts (Magnan, 2007; Pearl-Martinez & Stephens, 2016; Stiglitz, 2014).

Glander-Dolo (2017) studied the factors that affected the psychological well-being and health of women faculty in higher education and administered several online surveys to test the coping skills and environmental factors that challenged their well-being. Using the Folkman and Lazarus Ways of Coping Questionnaire (1988) and Diener’s (1985) Satisfaction with Life Survey, the main occupational stressors that emerged from the findings was lack of acknowledgment, no professional recognition, no rewards for work-related accomplishments, lack of parity in the form of leadership promotions, and being overlooked for salary increases.

In 2018, relative to the comparative employment wages between men and women, the U.S. Census Bureau found that there was a 38% gendered wage gap among women working full-time regardless of the occupation or workforce industry. Consequently, this suggests that for women, unequal pay means they are less likely to have the flexible income needed to save for retirement, maintain economic stability, and have adequate financial support for their children or aging family members (Tucker, 2017). In comparison to men working in STEM-related fields, women are also more likely to experience the psychological strains and job pressures that undermine their ability to succeed or advance to positions of leadership in male-dominated work environments and cultures. In this case, addressing the physical structure of the built environment becomes less important than modifying the ecological, social climate, and corporate policies that lead to equity issues in the gendered work climate (Moffatt & Kohler, 2008; Hassler & Kohler, 2014).

STEM Workplace Climate

Relative to the built environment and workplace climate, researchers have demonstrated that the exterior surroundings, interior designs, and employer policies of the workplace can either decrease or increase employee job satisfaction, productivity, and health-related behaviors (Center for the Built Environment, 2012; Kopec, 2006; Marzec et al., 2011). For instance, the contextual features of the built environment and building designs that influence positive mental health among employees are a sense of community, green space, open space layout, and quality social interactions (Hartnell et al., 2011; Kopec, 2006; Maas et al., 2009). Additionally, achieving a positive work-life balance for overall wellness and reducing attrition was a high need area (Coyle Van Leer et al., 2015; Robnett, 2016; Settles et al., 2012).

WHO (2017) describes health as "a state of complete physical, mental, and social well-being and not merely the absence of disease and infirmity" (Dunn, 1959, p. 789). Conceptually, to design a favorable physical workplace environment and climate/or culture that attracts and retains specifically women, employers are investing in well-designed organizational structures and offering more amenities that are applicable in the office setting and oil field drilling worksites (API, 2015). From a group and individual perspective, this may influence healthy workplace behaviors, attitudes, and positive social interactions, which may increase job satisfaction and employee performance outcomes (Carroll, 2019; Rick et al., 2017b).

The literature does suggest that by retaining younger talent and demonstrating gender diversity at all levels of the organization hierarchy, a firm may improve its competitive reputation by attracting more STEM college graduates (women), hiring women with experience in core STEM fields, gain worldwide market advantages in the O & G and petrochemical distribution sectors, improve jobs satisfaction, and create sustainable market growth (American Petroleum Institute, 2015; International Labour Organization, 2018; Knoll Workplace Research, 2015; Pellegrino et al., 2011).

Employee Wellness and the Built Environment

The environmental health factors viewed as positively inducing the well-being and job satisfaction among employees in various job categories in the O & G industry are: (a) shorter work shifts, (b) supervisor support, (c) employee involvement in policy decision-making, (d) more autonomy to organize work tasks, (e) workshops on emotional intelligence and managing stress, (f) building trust with senior-level managers, and (g) coordinate group or team social activities (Shin, 2016). Environmental researchers that study the well-being and mental health of employees assigned to an office setting demonstrated that there are potentially harmful effects connected to employees spending most of their scheduled workday inside an office space with little exposure to natural sunlight and greenery.

Due to the limited spatial arrangements and adverse conditions such as exposure to biological hazards, poor air ventilation, and psychological strain, these in-door or out-door conditions can impact the health and safety of employees (Mogan et al., 2013). These poor working conditions can cost U.S. employers up to $150 to $200 billion per year in absenteeism, lower employee productivity, staff turnover, worker compensation claims, higher healthcare costs, and other work-related stress-induced costs (Maxon, 1999; White, 2015). Evans and Stecker (2004) contend that a great work environment should create leadership advancement opportunities for employees, engage in shared and team decision-making, and improve their professional self-concept to encourage long-term employee retention.

Despite the increase in the number of collegiate women studying core science and technology disciplines, women working in core STEM or STEM-related careers view these industries as challenging career paths due to the male cultural norms of the traditionally masculine workplace environment (Williams et al., 2014). In contrast to non-STEM career fields, there are traditional gendered patterns in the culture of the STEM work environment that mainly affect or disadvantage women rather than their male counterparts (Myers et al., 2019). Specifically, there are (a) fewer female role models in leadership positions; (b) a lack of flexibility; (c) issues with family-life balance; and (d) internal policies that result in structural gender inequity (Williams et al., 2012). These working conditions are deemed as contributing to a stress-strain work climate that leads to job burnout, weak interpersonal social interactions, isolation, reduced job satisfaction, and employee attrition (American Institute of Stress, n.d.; Xu, 2008).

Other researchers studying environmental challenges from the lens of professional workers documented that the daily hazards related to characteristics of the work environment, heavy workloads, extended shift hours, low salary compensation, and interpersonal conflicts that undermine employee health and job satisfaction (Meyers et al., 2019; Kessler et al., 2008). In the current workplace culture, across industry types, workplace aggression, such as verbal threats or bullying and poor interpersonal communication, negatively impacts workers and can have an indirect effect on consumers and the economic profitability of the company (Leder et al., 2016).

Although personal characteristics play a role in the trajectories related to job dissatisfaction, the organizational climate and structural barriers also have a significant role in shaping the outcome of employee's physical and mental health concerns (Cech & Blair-Loy, 2010). One of the most critical actions employers can take to protect the well-being of employees is to offer supportive wellness programs and distribute information to improve the health and well-being of STEM employees. Previous environmental studies on workplace climates investigated factors that were associated with negative workplace satisfaction (Settles, 2014); employee attrition (Hunt, 2016); STEM work climate (Myers et al., 2019); gender discrimination and stereotypic beliefs (Carli et al., 2016) and social connections (Cech & Blair-Loy, 2010) and found that a healthy work climate required structural changes in the STEM built environment to retain talented staff and recruit college graduates.

For employers to maximize their recruitment efforts, they need to (1) work closely with universities to expand the underrepresented demographics of the pipeline and address gender and ethnic imbalances (Myers et al., 2019); (2) offer systemwide employee programs that impart valuable information on improving emotional stress (Rick et al., 2017b); (3) offer therapeutic counseling services to empower and retain talented women (Myers et al., 2019); (4) offer same-gender mentoring to improve the psychological well-being of women and encourage promotional advancement (Dreher & Cox, 1996; Williams et al., 2014); and (5) make available health-promoting amenities to promote positive mental health outcomes (Hartig, 2008; O’Neill, 2016; Virgili, 2015).

STEMinism and Retention of Women in the Oil and Gas Industry

Although women are amongst the largest segment of the workforce in the U.S., they represent only a fifth of employees in the O & G workforce, thus representing the lowest number of employees in other STEM and non-STEM occupations (Rick et al., 2017a). While there are several explanatory reasons that contribute to the STEM gender gap or leak, the O & G industry is failing to retain a critical pool of available talent, which are STEM women and URM professionals. Myers et al. (2019) refer to this gender workforce imbalance as STEMinism, which is conceptualized as structural inequalities that primarily disadvantage women and people of color working in male-dominated science and engineering fields (p. 2). Rick et al. (2017b) proposed that this potential human capital loss has a significant impact on global society and the overall industry.

The pervasive implications caused by STEMinism is explained by Rick and colleagues in the following statement,

> First, O & G companies have a smaller number of highly qualified candidates to choose from when filling positions, especially in the middle and higher ranks, because many talented women either never join the industry or leave prematurely. Second, these companies miss out on the higher quality of teamwork, diversity of perspectives, and creativity in the solving of technical and business problems that characterize those with larger percentages of female employees. Third, the industry's relative lack of gender diversity, particularly in the senior ranks, hurts its reputation among women as a career choice. (p. 4)

This potential outcome could negatively limit the O & G industry's ability to produce more diverse human capital (i.e., new knowledge and innovation), especially since it is expecting three-quarters of its experienced STEM professionals to retire in the next several years. To draw from the STEM pipeline (Underhill & Freer, 2013), this would require recruiting the untapped human resources, such as women and URMs, to fill different job categories, from the corporate office setting to the oil field (Eccles, 2011; The White House, 2007). As such, the challenge for businesses, according to Glass et al. (2013), regarding the collegiate STEM pipeline is that women and students of color are underrepresented in all the STEM-related disciplines in both public and private universities.

Equity and Career Advancement in STEM

Myers et al. (2019) purported that the STEM pipeline does not provide an equal opportunity to all Americans and nor does it promote the numerical critical mass hiring of women and underrepresented groups affected by STEMinism practices. As noted earlier, the term STEMinism is conceptualized in the literature as structural inequalities that disadvantage primarily women and people of color working in male-dominated science and engineering fields (Myers et al., 2019). In response to the annual World Petroleum Council's report authored by Rick et al. (2017b), they strongly suggested that the O & G industry address the sex-gender gap to achieve a race/ethnic and gender balance in science-oriented male-dominated industries. Currently, in the O & G field, “women make up 27% of entry-level employees, 25% of mid-level positions, 17% of senior-level jobs, and 1% of CEOs in the petroleum industry” (Rick et al., 2017b, p. 9).

Moreover, women are less likely to be hired for technical or oil field jobs, which is considered a steppingstone to advance toward senior-level or top leadership positions in the petroleum and O & G industry (Gyan, 2013; Williams et al., 2014). Considering these implicit issues of underrepresentation of women, Rick et al. (2017a) recommended that organizations focus on implementing three critical leadership career pathways to create gender balance in the STEM petroleum industry: (1) Entry Level, (2) Mid-Career level, and (3) Senior-Leadership track. A summary of the three pathways is described as:

Entry Level

Designed to eradicate discriminatory hiring practices that benefit men over women, organizations should expand the recruitment pipeline it draws from by increasing women's participation in STEM programs (Glass & Minnotte, 2010). This can increase interest in STEM as a viable career option for women and promote the broad range of different occupations available in the O & G workforce. Additionally, companies could increase the number of senior-level females in management and assign them mentoring assignments for new hires (Guy, 2003; Guy & Fenley, 2014).

Mid-Career Level

Ensure that the petroleum industry provides the same promotional opportunities and benefits to women as men and equal salaries for the work performed. Companies should provide career counseling to women to help them navigate their career paths within the industry (Guy & Fenley, 2014).

Senior-Leadership Level

The petroleum industry should provide training and mentoring to support and help women advance to senior leadership positions. Also, as more women decide to seek promotional opportunities, human resources (HR) should install and monitor checks and balances as oversight to guide unit managers in the selection and hiring process for qualified candidates (Guy & Killingsworth, 2007). To accomplish this goal, HR would need to make sure that hiring managers at the CEO and middle management level are giving equal consideration to hiring women candidates and offer them the same salaries as their male counterparts in the company.

These recommendations reported by Rick et al. (2017b) on behalf of the WPC are designed to steadily increase, retain, and advance the careers of underrepresented women and minority groups employed in the O & G industry. Moreover, the focus on achieving gender equity in the workforce may stop the leak in the STEM pipeline and improve the global image of the industry as being a socially responsible firm that aligns with gender fairness, a family-friendly environment, and supports the occupational advancement of women (Wilson, 2016).

Chapter Summary

In Chapter 2, titled "The Literature Review," I provided a synthesis of historical and contemporary research literature on the well-being and retention of STEM women employed in the male-dominated petroleum and O & G built environment. In this context, the term "built environment" refers to the material, spatial, and cultural activities of human labor, which includes where people live, work, play, and socialize with each other (Dearry 2004). The specific work-related factors that prevent employees from succeeding or advancing in the workplace are identified as work-related stress, psychological burnout, frequent absences, lower job satisfaction, and underperformance, which are posited as having a direct and indirect challenging impact on the employee and the employer (Elovainio et al., 2000).

Additionally, an employee's cognitive performance, health behavior, creativity, attitude, and organizational commitment are also negatively impacted over time (Gray & Birrell, 2014). The perceptions of the workplace design and mental health issues stimulate questions relative to occupational fit within the built environment and are linked to the P-E Fit theoretical perspective, which suggests that the fit between people's differences and the environment are strained when they perceive incongruency between the two elements (Mackey et al., 2016). More specifically, Edwards (2008) conceptualizes fit as “the congruence, match, or similarity between the person and environment” (p. 168).

Presently, in the modern petroleum workplace, which has remained traditionally male-centric, firms are aware of the importance of creating a “good design” or “good fit” to attract and sustain talented women and men employed in the petroleum and O & G industry but lack awareness of the emotional triggers of older and younger adults (Knoll Workplace Research, 2015). It is well documented that the effects of a poor physical and mental health environment cause personal mental and physical obstacles among employees, thereby causing unintended employee attrition (Berthelsen et al., 2015). Organizations that are perceived as having a poor work environment are more likely to experience higher attrition, and organizations experience a critical shortage of talented and qualified workers to meet workforce demands long-term (Chenoweth, 2015).

Currently, collegiate and professional career women across ages are significantly underrepresented and understudied in core STEM fields such as engineering, physical science, computer technology, and engineering. For over 20 years, the science and technology research community has increased and directed both national attention and recommended proven strategies to recruit and retain professional and millennial STEM women at the professional level after college and as faculty members in academia. To address the leaky pipeline, which is defined as the loss or attrition of talented women and underrepresented groups at the collegiate level and in the professional workforce

(Blickenstaff, 2005), organizations must remove the structural barriers that reduce the organizational commitment and well-being of women in STEM fields.

Despite industry efforts and actions to mitigate gender equity issues, implicit and explicit gender biases still persist in male-dominated STEM fields for three principal reasons (Blickenstaff, 2005; Myers et al., 2019). First, there is the issue of STEMinism (gender inequity) and the diversity of perspectives that can lead to new innovations and economic leverage in the industry. Second, there is a significant loss of talented women who decide to pursue other careers when they leave STEM occupations. Third, the field of science and technology, with the exception of the biological sciences, is less robust because of the underrepresentation of gender and ethnically diverse professions with nuanced work experiences, cultural backgrounds, ideas, and innovativeness.

The review of the literature also presented a summary of humanistic recommendations (i.e., focus on employee well-being and not corporate profits) suggested by Rick et al. (2017b) to help O & G organizations effectively hire and retain women in the STEM workforce long-term. Consistent with the intent of the recommendations suggested by Rick et al. (2017b), the potential contributions of the study are that it may bring attention to the mental health issues that adversely affect STEM women in the petroleum sector-built environment and expand the discourse, which is currently limited on the well-being of women working in the male-dominated petroleum workplace environment. As such, the study findings may lead to new retention strategies and interventions to help mitigate the attrition of professional women working in the O & G field and women working in other STEM careers.

The next section, chapter 3, “Research Methodology,” introduces and describes the research approach and study design employed to explore the critical factors linked to the well-being and retention of women working in STEM occupations within the built environment of the petroleum and O & G industry and other core STEM fields.

Chapter 3: Research Methodology

Introduction

In this chapter the qualitative research design and approach employed to conduct the present investigative qualitative study on the well-being of STEM women working in the O & G industry and other male-dominated STEM fields is presented. An overview of the research questions and criteria for the selection of the research sample is explained, along with the data collection procedures, processing of the coded data, and the researcher's ethical considerations. In addition, trustworthiness of the qualitative approach, demographic profile questionnaire, and the two research questions and subquestions constructed to explore the effects of the built and ecological environment on the well-being of diverse women in STEM is reported. In the final section of this chapter a summary of the research methodology used for the current investigative study is provided.

Research Questions and Subquestions

The following research questions (RQ) and subquestions (SQ) that guided this study on the well-being of STEM women working in the O & G built environment or other engineering fields are,

Research Question 1 (RQ1): How do STEM women describe their work experience in the oil and gas-built environment or other related STEM settings, and how do these perceived experiences affect their physical, mental, and social well-being in the STEM industry?

Subquestion 1 ($SQ_1 1$):What are the perceived daily challenges experienced by women working in the oil and gas workplace environment or other STEM fields?

Subquestion 2 (SQ_21): Do the design characteristics of the workplace-built environment affect their behavior, mood, or mental health?

Research Question 2 (RQ2): What strategies do women employed in the oil and gas industry or other STEM fields use to manage occupational stress related to the ecological environment of the oil field worksite or corporate office setting?

Subquestion 1 (SQ_12): What work situations do women perceive as stressful regarding the oil field drilling site or other male-dominated STEM fields?

Subquestion 2 (SQ_22) What professional services or helping resources are available to employees in the organization to help reduce self-perceived stress or anxiety?

Study Rationale and Design

For this study a qualitative research method was selected because it is participant-centered and relies on in-depth interview data to explore and identify specific patterns or themes to make conclusions about the lived experiences of the research participants (Creswell, 2015; Merriam & Tisdell, 2015; Robson, 2002). With specific reference to the IPA approach, which was used for the present study, Alase (2016) stated that the goal of IPA is to understand a phenomenon as it is experienced by the study participants. Thus, the researcher must maintain specific mechanisms for validity (e.g., trustworthiness, member-checking, triangulation, and auditing), data gathering, and analyzing interview data.

The IPA is grounded in the sociological discipline (Patton, 2002), and is described by Lethbridge et al., 2005, Sim, and Singer (2005), as an appropriate method or approach to explore a phenomenon and gather informative data from multiple sources, including interview transcripts, interview summaries, and the researcher's observational data. I used the IPA method to explore the perceptions and lived experiences of the study participants and gain insight into the phenomenon under study (Van Maanen, 1979).

With reference to the phenomenology design, qualitative experts Bogdan and Biklen (1982) and Yin (2003) suggested that in-depth interviewing should be guided by open-ended questions that allow the researcher to (a) collect relevant details; (b) encourage respondents to openly share their point of view, rather than using control methods to direct the interaction between the researcher and participant; and (c) encourage participants to share their lived experiences freely. In the contemporary research literature, Harrison et al. (2017) described the "phenomenology approach research as a distinct form of inquiry that enables comprehensive and in-depth insight into a diverse range of issues across several disciplines" (n.p).

In summary, to conduct the qualitative interviews, the Smith et al. (2009) data-gathering plan for the phenomenological methodology was used as a research study guide to conducting the individual interview sessions with each confirmed respondent.

The Interpretative Phenomenology Methodology

For the present study, the IPA qualitative approach was selected to help the researcher develop a deeper in-depth understanding of the lived experiences of the physical and mental well-being of STEM women employed in the petroleum and O & G field or other STEM occupations. The primary objective of the current study design was to capture in-depth narratives from study participants through open-ended interviewing and recording observational field notes using the exploratory methodology. In comparing the qualitative methods or traditions employed for data analysis purposes (e.g., Grounded

Theory, Case Study, Interpretive Phenomenological Analysis, Narrative Research, and Ethnographic Research), Creswell (2013) stated that:

> Across all five approaches, the researcher typically begins by creating and organizing files of information. Next, the process consists of general reading and memorizing of information to develop a sense of the data and to begin the process of making sense of them. Then, all approaches have a phase of description, except grounded theory, in which the inquirer seeks to begin building toward a theory of the action or process. (p. 200)

Alase (2017) argues that researchers who conduct qualitative studies are better able to apply both their interpersonal and subjectivity abilities to find meaning from the lived experiences of the study participants because of the focus on the participant's experiences. Further, Alase stated that when the interpretive phenomenological analysis (IPA) approach is utilized, which is a participant-oriented technique, the investigative benefits increase due to the focus on understanding how participants experience the common phenomenon under investigation. Researchers establish a closer relationship or bond with their study participants, thereby producing more detailed information on the phenomenon, which is the participants lived experiences. As such, this information may result in stronger credibility and transferability of the research data and findings (Creswell, 2015; Moustakas, 1994).

Examining the Research Phenomenon

To gain insight into the phenomenon associated with perceived experiences, a diverse sample of women employed in different types of positions, such as upper-level managers, supervisors, finance, HR, oil field workers, engineers, office administrators, and clerical workers, were recruited to gain in-depth information on their lived experiences in the STEM built environment. The information relative to the ecological experiences and challenges (e.g., job satisfaction, promotional opportunities, gender discrimination, quality of social relations, mental health challenges, and self-care services utilized) of the workplace was explored in-depth to gather interview data over a period of 2 to 4 weeks and transcribed verbatim into a Microsoft Word document. To perform thematic analysis and to extract meaningful interpretation from the collected data, the interview data and field notes were thematically color-coded and categorized accordingly.

Creswell (2012) expressed that a “phenomenological study describes the common meaning for several individuals regarding their lived experiences of a concept or a phenomenon” (p. 76). When building a sample for a phenomenological study, the research suggests that five to 10 study participants with similar experiences (the phenomenon) should be interviewed to determine the homogeneity of their lived experiences (Creswell, 2013, 2015; Patton, 2015; Smith et al., 2009).

Purpose of the Study

The primary purpose of this qualitative study was to explore the effects of the ecological conditions of the built environment on the physical, social, and mental well-being of women employed in the O & G industry or other STEM fields, including the helping resources used in the workplace. Furthermore, my focus was to extract breadth and in-depth information from the participant interviews on their lived experiences and perceived occupational stressors connected to the office or worksite design and interrelated characteristics of the work environment.

Although there have been improvements in correcting gender inequity in different STEM domains, Settles et al. (2016) noted that additional research is needed on the structural design, organizational culture, and pressure demands that impact women in STEM fields. They suggested that this type of information will produce new identity-based knowledge since understanding how to support STEM women in the workforce is understudied when considering the factors that influence the psychological and career attrition or success outcomes of STEM women working in male-dominated career fields.

Role of the Researcher

As the sole researcher for the present study, with a professional background in the O & G STEM field, my goal was to remain neutral and objectively understand the professional experiences of the STEM women to extract meaning from their personal narratives (Creswell, 2009). In this context, to conduct a qualitative phenomenological study, semistructured interviews on the lived experiences entailed collecting and grouping responses and preparing observational field notes to help shape the data findings and phenomenological analysis process (Yin, 2013). Throughout the interview process, the researcher’s role is to listen, observe, ask probing questions to guide the interview process, capture participants' individual perspectives, collect data, and develop an understandable interpretation of the phenomena through feedback loops and member checking for accuracy of the data (Creswell, 2014; Thomas, 2017).

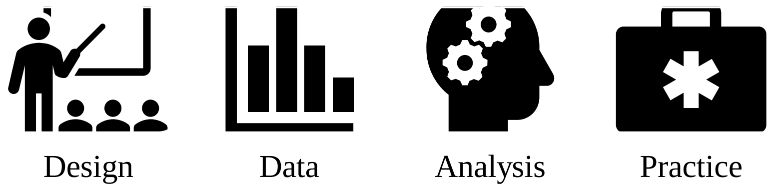
Moustakas (1994) recommends that during the analysis process, if the researcher has personal experiences with the phenomenon under study, they must *bracket* themselves of any preconceived notions regarding lived experiences. As a result, I listened attentively to understand the lived experiences from the lens of the research participants without preconceived or unwanted biases.

Conducting The Qualitative Research Study

Methodologically, the factors and information sources used to gather relevant interview data and gain an in-depth understanding of the phenomenon included HR policy documents, information related to their occupational field, researcher field notes, and mental health and counseling resources available to those experiencing psychological challenges. For this study, I adopted recommendations provided by Runeson and Host (2009) and Creswell (2015) on employing a standardized interview protocol (procedures) to guide the planning and implementation of the qualitative study. Runeson and Host (2009) purported that the research design and implementation of a research plan should include the following information: (a) Research design and approach (study objectives, interview protocol, saturation), (b) Data collection content (identify multiple data sources for information); (c) Analysis of the data (meaning applied to the collected data); and, (d) Implications for practice that may be useful to the research community and practitioners in the workforce (see Figure 1).

Figure 1

Steps to Phenomenology Design Planning



Note. Illustration derived from Runeson, P., & Host, M. (2009). Guidelines for conducting and reporting phenomenology-related research in software engineering. Empirical Software Engineering, 14, 131-164.

Participant Selection

Creswell (2013) notes that when researchers are selecting participants, “it is critical that “you select people or sites that can best help you understand the central phenomenon” (p. 206). For the present study, women engineers residing in the northern, Southern, Eastern, and Western tiers of the United States were the participants. Once Walden University granted IRB approval to conduct the study using human subjects, the participant recruitment and selection process started with first finding potential STEM women that were interested in participating in semistructured interviews. This entailed exploring their willingness to share information on their personal and professional lived experiences working in the male-dominated STEM sector.

Participant Sampling Criteria

The sample of STEM women employed in engineering fields for this qualitative study included varying ages, education levels, and ethnicity. All the single-gendered research participants for the study were derived from various engineering fields and worked in positions such as senior or middle-level managers, finance, human resources, engineers, clerical personnel, oil rig operators, and office administrators employed for at least a year in the O & G industry or another STEM-related field. These different job categories helped to establish broad viewpoints about their lived experiences and perceptions regarding the workplace environment and overall well-being associated with their career challenges, work conditions, and work experiences as women in the male-dominated STEM workplace.

Guest et al. (2006) suggested that an acceptable sample size of 15 or higher is adequate for qualitative studies. The five criteria's identified for the potential sample of participants were: (1) identify as female; (2) work full-time or part-time (25 hours a week) in a male-dominated STEM industry; (3) have at least one year or more of employment tenure in the STEM workforce; (4) work in the built environment such as an office building setting or in the field in a STEM-related occupation; and, (5) have personal experience (past or present) or knowledge of the STEM work environment and onsite workplace interactions.

Recruitment Approach

Using both convenience (i.e., a nonprobability technique that is used to conveniently or purposively recruit or sample participants) and the snowballing sampling technique (i.e., word-of-mouth network referrals by participants in the study), for this qualitative study, participant outreach began with first contacting my professional network of women engineers. I contacted two professional women engineering organizations as a recruitment strategy to identify those that satisfy the inclusion participant criteria. Once Walden University's IRB office granted IRB approval, a general STEM organization for professional woman was contacted to obtain their support and permission to forward a digital recruitment flyer targeting active members of the professional organization. The outreach flyer explained the purpose of the study, and the research selection criteria for female STEM professionals to join the study. The electronic introductory recruitment letter or flyer (see Appendix A) forwarded to the STEM member organization asked that they post the research invitation on their digital social media sites, such as the organization's LinkedIn professional network page, Instagram, and Facebook bulletin board with my direct contact information.

The second recruitment approach following IRB approval was associated with requesting permission to use the Walden University Participant Pool to post the doctoral level study on the site for the Walden community of students along with the inclusion criteria. However, this outreach method was not approved by Walden University due to the explanation that this method would likely not increase the possibility of finding STEM women that met the study inclusion criteria. To recruit the 16 eligible participants that meet the inclusion criteria for the study, the third recruitment approach was the snowball sampling technique (word of mouth network referrals), which was employed for outreach purposes within a timeframe of 2 to 4 weeks after Walden University granted IRB approval. Together, these three recruitment approaches were used to draw an adequate research sample of women for the STEM study.

For those that satisfied the research criteria and agreed to participate voluntarily (i.e., no monetary incentives will be offered), I first obtained their informed consent via email with the statement "I consent" typed in the body of the email addressed to the researcher. A virtual online interview or confidential telephone conference call was then scheduled with the selected participants. The self-reported demographic profile survey (see Appendix B) was sent electronically by SurveyMonkey to the prospective participant's email with instructions on how to complete and return the demographic survey electronically to the researcher before the scheduled interview session.

Protection of Human Subjects

For the protection of human subjects, the selected research participants that satisfied the research sample criteria received detailed information on the purpose of the interpretive phenomenological study. Additionally, each participant was assured that their interview responses and personal information would remain private and confidential, and all information collected for the study will be utilized for research purposes only. Each participant was also informed of the option to discontinue the interview at any time, without penalty if there are concerns regarding reprisals, right to privacy issues, or for personal reasons not disclosed to the researcher.

All prospective research participants were asked first to provide informed consent to comply with the human subject’s protection procedures required by Walden University’s IRB office. To provide informed consent, prospective participants were asked to read the informed consent letter, and if they decided to participate in the study, they were instructed to send a message to the student researcher via e-mail with the words, “I consent” in the body of the email. This indicated that they have consented to participate in the study and agreed to all the terms discussed regarding their participation, such as completing the demographic survey and virtual semistructured interviews, which is discussed in the informed consent. Participants were instructed to retain a copy of the informed consent for their personal records.

Once I obtained the emailed informed consent statement from the confirmed sample of women, they were asked to complete a confidential demographic profile survey using an assigned alphanumeric pseudonym as their personal identifier before conducting the semistructured online interviews. Due to the global coronavirus COVID-19 pandemic, face-to-face in-person interviews were not conducted by the researcher. Each participant was scheduled for a 60-minute online interview or telephone call conference. To protect their privacy, the researcher conducted the interviews in a private office space at her home residence to protect the confidentiality of the participant's verbal interview responses without any disruptions or distractions. Prior to the interview, the researcher asked participants to sit in a comfortable and private office space or location while participating in the 60-minute confidential Zoom or Skype cloud-based interview or conference call.

The data collection procedures for managing sensitive data suggest that, with respondent's permission, if a hand-held audio recording device is used to record participant interviews, the information must be de-identified, and pseudonyms must be assigned and used on all the research documents to maintain the confidentiality of their personal information and maximize complete anonymity (Patton, 2015). In the case of the current research study, the semistructured interview was recorded using the audio videoconferencing tool to capture the verbal exchange with the participant's permission virtually. Paper documents generated, such as the interview transcripts, observational notes, and researcher field notes, were stored and secured in a locked file cabinet that could be accessed and retrieved by only the researcher. Thus, the researcher is the only one that has key access to the confidential research-related documents collected for the present study. A five-year data retention timeframe will be implemented.

Demographic Profile Survey

For the present study, prospective research participants completed and emailed the online informed consent before they proceeded with the self-reported demographic profile survey and virtual cloud-based interviews or conference calls (see Appendix B and C). The digital self-reported demographic survey was distributed to each eligible and confirmed study participant recruited for the study using the SurveyMonkey platform. The online demographic survey collected personal background information related to age range, educational level, marital and parental status, family size, ethnicity, work location, full-time or part-time employee, leadership, or non-leadership position, tenure in the STEM field, and access to stress-relieving resources. These twelve demographic profile questions helped to improve the understanding of the participant's job role, educational attainment, family responsibilities, and work experiences as a female in a male-dominated STEM-built environment (see Appendix B).

Researcher Developed Interview Protocol

The extensive literature review helped to develop the interview protocol for the present qualitative study. The literature obtained on the subject of wellness and the built environment, mental health issues in the workplace, influences on the well-being of STEM women, and the attrition (gender imbalance) of STEM women in the O & G field encouraged the development of the interview protocol questions that will be used to guide the research study and answer the two research questions.

Interview Protocol Questions

The semistructured interviews with open-ended questions were developed with guidance from the review of the literature. The advantages of using this type of interview technique are the flexibility that it provides for virtual face-to-face interviews with participants. The interview protocol consisted of six questions and guiding probes to help answer the two primary research questions and sub-questions and helped participants clarify their responses. This qualitative approach yielded useful information that was needed to understand the potential phenomenon and possible narrative themes. The research questions are as follows:

Research Question 1 (RQ1): How do STEM women describe their work experience in the oil and gas-built environment or other related STEM settings, and how do these perceived experiences affect their physical, mental, and social well-being in the STEM industry?

Subquestion 1 ($SQ_1 1$): What are the perceived daily challenges experienced by women working in the oil and gas workplace environment or other STEM fields?

Subquestion 2 ($SQ_2 1$): Do the design characteristics of the workplace-built environment affect their behavior, mood, or mental health?

Research Question 2 (RQ2): What strategies do women employed in the oil and gas industry or other STEM fields use to manage occupational stress related to the ecological environment of the oil field worksite or corporate office setting?

Subquestion 1 ($SQ_1 2$): What work situations do women perceive as stressful regarding the oil field drilling site or other male-dominated STEM fields?

Subquestion 2 ($SQ_2$2) What professional services or helping resources are available to employees in the organization to help reduce self-perceived stress or anxiety?2**.** What professional services or helping resources are available to employees in the organization to help reduce self-perceived stress or anxiety

The six interview questions are the following:

1. Were you recruited for employment in the oil and gas industry or another STEM field or did you seek STEM job opportunities in this field because of your educational background or specialized skills? Probing question: (a) Was salary a critical factor in deciding to work in this STEM sector? (b) What were your initial thoughts or concerns about working in a male-dominated industry?
2. How do you define occupational stress? Probing question: (a) Think about some of the challenging situations that you have experienced in the current workplace.
3. What work situations do you find stressful in the STEM work environment? Probing question: (a) Reflect on work situations that you typically find stressful in the present or past work situations relative to the male-dominated workplace; it could be the present employer or another firm.
4. Describe how you feel about the quality design of the built environment in the engineering field? How does it affect your overall sense of well-being? Probing questions: (a) Describe how the design of the worksite, the employee provided housing, and office building affects your behavior, attitude, mood, or physical health, (b) Explain if you feel comfortable, happy, satisfied, stressed, or frustrated in the current workplace environment.

5. What self-care services or mental health resources do the organization provide employees as a tool to help manage occupational stress and maintain a healthy work-life balance? Probing question: (a) Reflect on any personal or professional services that are available and promoted by the organization to help employees experiencing stress or anxiety.

6. What coping mechanism do you practice caring for your physical health and overall mental well-being in the current workplace and to manage occupational stressors (e.g., anxiety, time pressure, depression, stress)? Probing questions: (a) What self-help strategies do you use to maintain your physical and mental health and explain why you feel "they are or are not" effective in maintaining your health and controlling stress-related responses, (b) does the organization provide e-mail counseling, face-to-face counseling, time off or formal or informal group talks (i.e., lectures) on stress management and wellness topics?

Data Collection and Analysis Procedures

The researcher was the sole person responsible for the data collection process, which included data transcription and transcript analysis. Once the completed demographic surveys were submitted to the researcher and the semistructured interviews were finished and transcribed, participants were emailed the transcribed interviews to review and verify the accuracy of the collected interview data. If the interview responses and verbal exchanges between the participant and researcher were incorrectly transcribed, the data analysis process began with correcting the discrepancies and performing the necessary editing. The main goal of the data analysis process was to answer the two research questions and sub-questions and extract rich, understandable, and meaningful narrative data from participants for interpretation of the collected data. There were three triangulated data sources: (1) semistructured interview data; collected and transcribed verbatim into a word document, (2) researcher field notes; and (3) any other relevant documents provided by the participants (Creswell, 2015).

Any incomplete data collected was removed from the analysis process to maintain the accuracy and dependability of the collected data. The next step was thematic color-coding, categorizing, and organizing the data using NVivo statistical and data analysis software, SurveyMonkey, and hand-coding. The in-depth thematic color-coding data analysis and management processes used for this study helped with identifying frequently used words, emergent themes, perceptions, and verbal patterns derived from the recorded qualitative interviews with the respondents until data saturation was reached. Acknowledging that the thematic analysis technique or process is similar to other qualitative data analysis methods, Al-Jaghoub et al. (2010) outlined three practical considerations that will be used to help guide the thematic coding process for the qualitative researcher: (1) data reduction, (2) data display, and (3) data verification. These three methods are described below.

1. *Data Reduction***.** This step is a continuous process that starts before the data collection stage and involves a review of the literature and designing a conceptual framework to manage the textual interview data. The process is inductive and deductive and ends when the interview data summaries are reduced and understandable to the researcher. Qualitative studies can produce a large amount of data, which is why the reduction step is critical to managing and organizing the collected data.

2. *Data Display***.** It allows the reader to understand the information collected by the researcher and to draw conclusions from the interview data. Thus, thematic color coding and categorization are needed to manage and make sense of the collected data.

3. *Data Verification*. This last step of the data analysis process focuses on drawing conclusions and performing member checking of the results with interviewees. Thus, the focus is on identifying word patterns, data themes and making the collected sources of information understandable to arrive at a relevant conclusion and study implications.

Trustworthiness and Confirmation of the Data

With regard to collecting quality data, this study followed the criteria used by Lincoln and Guba (1985) to evaluate the trustworthiness of collected data for qualitative research. This evaluative process included ensuring credibility, transferability, and confirmability (Mertens, 2005). Credibility refers to having trust in the research findings. Transferability relates to generalizing the results to other similar studies, and confirmability suggests that that the results are unbiased and are not reflective of the researcher's personal views. Therefore, first close attention focused on obtaining quality and untainted viewpoints, thus utilizing self-monitoring and bracketing to remain consciously neutral and mindful of any pre-conceived held assumptions related to the personal and professional experiences shared by the interview participants.

Throughout the interviewing, data collection, and data analysis process, it is essential first to become desensitized from the personal experiences of the respondents regarding the unfolding of emerging themes from the interview results. Second, I revisited the final transcription of the research data without bias to confirm that the results reflected the accuracy of the respondents' perceptions. By employing bracketing as the sole researcher, I was able to objectively compare my perspectives with those of the respondents to develop a deeper understanding of the phenomenon as part of the bracketing process (Evans et al., 2018; Hesser-Biber, & Piatelli, 2012).

Ethical Considerations

With regard to ethical considerations, I followed the IRB guidelines outlined by Walden University for doctoral candidates. To protect the true identities of the interview participants, only the researcher and respondents have knowledge of their legal identifying information. This private information will be kept entirely confidential on a password-protected personal computer for *five years* as required by Walden University's IRB office. For this phenomenological approach, complete anonymity was maintained by assigning participants an alphanumerical pseudonym on all documents or forms connected to the research study to protect their identities.

Finally, to conduct the ethical function of debriefing at the end of each interview session, participants were given the opportunity to converse with the researcher about the purpose of the study and share their personal experience and involvement as respondents and receive immediate and honest feedback in real-time (Sharpe & Faye, 2009). Additionally, participants and the organizations they are associated with were reminded that they could contact the researcher electronically at any time to request information regarding the outcome of the investigative STEM study.

Chapter Summary

Chapter 3 discussed the main purpose of the present study, which was to explore qualitatively the built environment and ecological conditions that impact the retention and mental, physical, and social well-being of STEM women working in the engineering field or other STEM fields. The research methodology employed for this study, Interpretive Phenomenological Analysis (IPA), is an approach that has the ability to effectively capture and interpret the lived experiences of women employed in the built environment of the STEM industry. In general, expert phenomenologists Smith, Flowers, and Larkin (2009) described the phenomenology methodology as an analytical method used to investigate and interpret the everyday *lived experiences* of study participants from their perspective without penalty. They also noted that the IPA method is "committed to the examination of how people make sense of their major life experiences" (p. 1).

IPA employs an open-ended semistructured interview method that is deemed flexible in nature. This chapter presented the two interview questions and sub-questions and explained how participant data would be collected and transcribed verbatim into a word document and thematically color-coded by the researcher for the analysis step. Alase (2017) and Creswell (2013) contend that researchers that conduct qualitative studies are allowed to consider their own interpersonal experiences to discover the underlying meaning from the lived experiences of the research participants. However, to extract the researchers' personal beliefs on the well-being and experiences of women in the O & G field, bracketing (consciously shelving personal biases) was used during the interviews and data transcription process. This helped to avoid predilections or assumptions that could result in inaccuracies in the data findings and interpretations (Fischer, 2009).

Alase also emphasized that when the IPA participant-oriented approach is utilized, the advantages increase the significance of the findings because researchers have a closer relationship or bond with the participants. Understandably, this could produce more detailed information on participants' lived experiences and result in thoroughly exploring their perspectives and beliefs to generate quality data. In turn, the credibility and transferability of the research findings are enhanced to elevate the trustworthiness of the data. In the next section, Chapter 4, the study findings are presented. With reference to the qualitative interview protocol, the respondent answers to the interview questions are reported and discussed in detail to address the research questions and subquestions. A discourse on the thematic coding procedure and outcome of the data analysis process is also presented in the next chapter.

Chapter 4: Results

Introduction

The purpose of the present study was to employ a qualitative phenomenological approach to explore the aesthetics and psychological effects of the male-dominated built environment on the well-being and subsequent retention of STEM women employed in the petroleum industry and other job sectors in STEM. First-hand narrative information on the personal struggles and lived experiences of the STEM women, were collected from research participants employed in male-dominated STEM occupations that included the physical sciences, technology, leadership roles, and engineering. Although the representation of women employed in the STEM workforce and those pursuing academic STEM majors has increased throughout the years, they remain disproportionately underrepresented in comparison to their male counterparts across age and ethnicity in all the STEM domains, with the exception of health occupations and medical laboratory sciences (Yanosek et al., 2019).

In the available research on the psychological well-being of women in traditionally male-dominated STEM fields and workplace stress, there is a gap in the literature on how and if the built environment negatively impacts the retention and well-being of women in the petroleum field and other related professions. Characteristically, this is viewed as problematic since women account for 47% of the total U.S. workforce and represent only 25% of employees working in STEM fields (White & Massiha, 2016). To address the research gap the IPA approach, which is grounded in the phenomenological and sociological discipline (Patton, 2002), was an appropriate method to examine the phenomenon under study and collect relevant narrative data from the gendered research sample. Therefore, the data derived from this study was gathered from the audiotaped open-ended semistructured interviews, interview summaries, and handwritten reflective observational notes. Chapter 4 will provide the results and a discussion of the data analysis of the emergent themes and subthemes generated from the collected interviews, the handwritten notes taken in real-time during the individual participant interviews, and a summary.

Research Questions

The two research questions and subquestions that guided this qualitative study were related to the lived experiences of STEM women and the strategies they used to manage occupational stress connected to the male-dominated workplace. The in-depth narratives obtained from the study participants through open-ended interviewing and the supporting observational field notes were used to address the two research questions and subquestions. The research questions and subquestions for this study are the following:

Research Question 1 (RQ1): How do STEM women describe their work experience in the oil and gas-built environment or other related STEM settings, and how do these perceived experiences affect their physical, mental, and social well-being in the STEM industry?

Subquestion 1 ($SQ_1 1$):What are the perceived daily challenges experienced by women working in the oil and gas workplace environment or other STEM fields?

Subquestion 2 ($SQ_2 1$): Do the design characteristics of the workplace-built environment affect their behavior, mood, or mental health?

Research Question 2 (RQ2): What strategies do women employed in the oil and gas industry or other STEM fields use to manage occupational stress related to the ecological environment of the oil field worksite or corporate office setting?

Subquestion 1 (SQ_12): What work situations do women perceive as stressful regarding the oil field drilling site or other male-dominated STEM fields?

Subquestion 2 (SQ_22) What professional services or helping resources are available to employees in the organization to help reduce self-perceived stress or anxiety?

To answer the two research questions and subquestions, the results derived from the data analysis step are presented and a summary of the demographic characteristics of the studyparticipants. Moreover, the data analysis coding and extraction procedures used to evaluate the interview data are discussed in detail, along with the major themes and subthemes that emerged from the statistical analysis process. Evidence of trustworthiness is also presented, which involved performing individual member checking of the transcribed narratives with each participant before starting the formal data analysis.

Recruitment Outcome and Demographic Characteristics

Guest et al. (2006) contends that an acceptable sample size of 15 or more study participants is an adequate number for qualitative studies, and despite the time constraints connected to the investigative process, the final number of participants recruited for the study resulted in a total sample of 16 urban and suburban women employed in different STEM occupations. The participants worked predominantly in the petroleum industry, and others were employed in related fields considered as traditionally male-dominated. The STEM women worked in traditionally male-dominated fields, such as the petroleum industry, and other work-related STEM fields, such as engineering, the physical sciences, and technology.

During the recruitment process for qualified participants, there were six women that were initially recruited within a 5-day timeframe. Each of the participants responded individually by email to the digital recruitment flyer that I posted on my LinkedIn social media site and on a digital bulletin board managed by a women's national STEM organization. To protect their identities, I responded individually to the electronic messages as opposed to sending one group email as a follow-up, to avoid revealing their legal identities and personal contact information To enlarge the number of confirmed participants for the study, I later reposted the digital recruitment invitation on my Facebook social media account, and used the snowball or chain sampling (i.e., word-of-mouth referrals from confirmed participants in the study) method over a 10-day period to recruit additional participants through the personal network of the confirmed participants in the study.

All the women recruited met the criteria to become a confirmed participant in this qualitative research study: (1) identity as female; (2) work full-time or part-time (25 hours a week) in a male-dominated STEM industry; (3) had at least one year or higher of employment tenure in the petroleum field or other STEM workforce occupations; (4) worked in the built environment such as an office building setting or in the field in a STEM-related occupation; and, (5) had personal experience (past or present) or knowledge of the STEM work environment and onsite workplace interactions. Once I confirmed the participants, each person was emailed an informed consent to read in order to offically join the study. To formally give their informed consent for the study, the participants emailed me as instructed in the informed consent letter and indicated in the body of the reponding email the statement “I consent” after reading and agreeing to the requirements of the informed consent.

To gather critical profile information or demographic charateristics on each confirmed participant, I sent each person a digital self-report demographic survey through SurveyMonkey after the informed consent was completed and received. The brief online demographic survey included background information related to one’s age range, educational level, marital and parental status, family size, ethnicity, work location, full-time or part-time employee, leadership or non-leadership position, tenure in the STEM field, and access to stress-relieving resources or services within the workplace setting (see Table 3). These 12 questions listed on the online demographic survey (see Appendix B) through the SurveyMonkey platform were critical to understanding the unique profile characteristics of the female participants and their tenure in STEM job roles, educational attainment, martial background, coping experiences as STEM women, and the perceived effects on their well-being in the different built environments.

The STEM women considered young adults (under age 40) represented the highest number of participants. They totaled 63% (*n*=10) of the study sample, while those that were age 41 and higher (middle-aged) represented 37% (*n*=6) of the sampled participants. As for their marital status, 63% of the sampled participants were single, with 19% listed as married and 12% were divorced. Interestingly, in the area of educational attainment, 44% of the STEM women had high school diplomas and 2-year associate degrees from a local community college, which was mistakenly not listed as an item on the demographic survey, but pointed out during the interviews. In the category of

Bachelor's degree, 25% had earned a degree in sciences, and two (12.5%) participants had earned a doctorate degree. In looking at their tenure in the STEM field, 69% had under 1 to 5-years of work experience in the field, whereas only 25% (*n=4*) had 6 to 10 years in the STEM field. There was only one person that had 11 years or higher in their STEM occupation.

Table 3

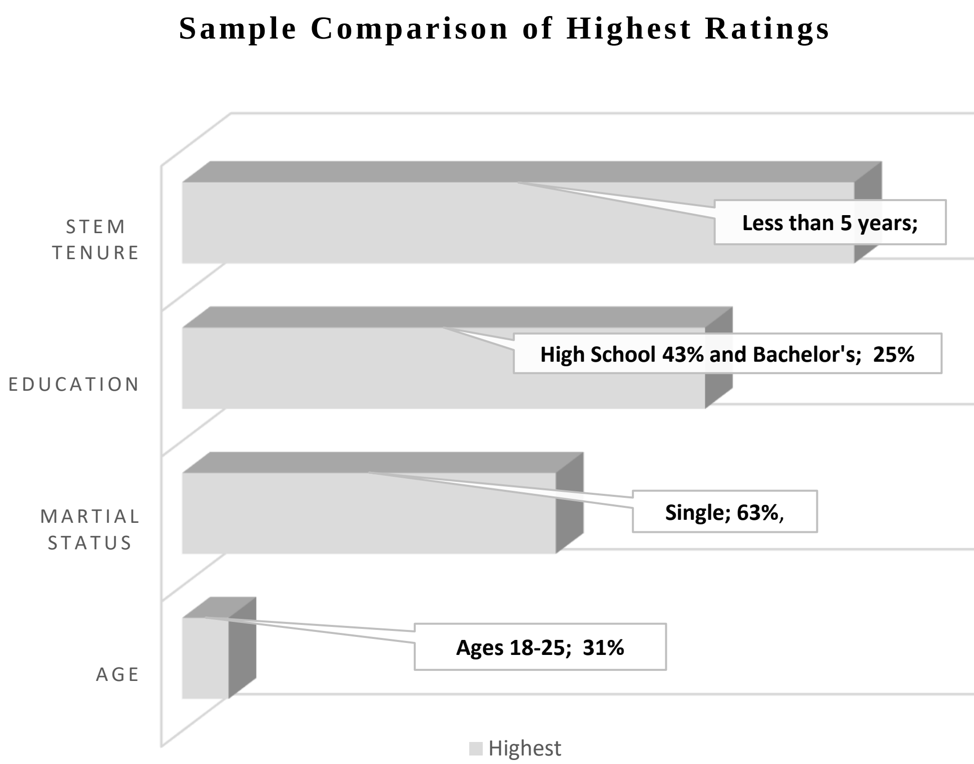
Demographic Description of STEM Women (N=16)

Demographics	Percentages	n
Age Range		
18- 25	5	31
26-33	2	12
34-41	3	19
42-49	3	19
50-57	2	12
58 or over	1	6
Marital Status		
Single	10	63
Married	3	19
Widowed	1	6
Divorced	2	12
Parental Status		
1-3	10	63
4-5	0	0
5 or more	0	0
No Children	6	38
Ethnicity		
White	2	12
Black or African American	11	69
Hispanic or Latino	1	6
Asian or Pacific Islander	0	0
Indian	2	12
Middle Eastern	0	0
African	0	0
Education Attainment		
High School	7	44
GED	1	6
Bachelors	4	25
Master's Degree	2	12
Doctorate	2	12

Employment Status		
Full-Time	5	31
Part-Time	2	12
Full-Time with regular overtime	9	56
Employment Tenure		
Less than 5 years	11	69
Between 6-10 years	4	25
Between 11-15 years	1	6
Above 16 years	0	0
STEM Tenure		
Less than 5 years	11	69
Between 6-10 years	4	25
Between 11-15 years	1	6
Above 16 years	0	0
Management Position		
Between 1-5 years	5	31
Between 6-8 years	4	25
Between 9-10 years	3	19
Above 11 years	0	0
N/A	4	25
Employees Supervised		
1-3	5	42
4-10	6	50
11-20	1	6
21 or higher	0	0
Non-Supervisory Position	4	2
Weekly Overtime Worked		
Between 0-3 hours	3	19
Between 4-5 hours	2	12
Between 6-7 hours	4	25
Between 8-10 hours	3	19
Between 11 hours or more	4	25
Stress Relieving Resources		
Yes	6	38
No	8	50
Yes, but I don’t have time to participate	2	12

Figure 2

Sample Comparison of Highest Demographic Ratings



Data Collection

I used a qualitative phenomenological research design for this study on STEM women employed in the petroleum and O & G profession and other STEM-related science fields. To answer the research questions with accuracy, I used Runeson and Host’s (2009) step-by-step qualitative analysis recommendations, with special attention focused on using a standardized interview protocol (procedures) to guide the planning and implementation of the research study. Runeson and Host (2009) purported that the research design and implementation of a research plan should include the following steps: (1) research design and approach (study objectives, interview protocol, saturation); (2) data collection content (identify multiple data sources for information); (3) analysis of the data (meaning applied to the collected data); and (4) implications for practice that may be useful to the research community and practitioners in the workforce.

After IRB approval was granted by Walden University (#04-22-21-0346460) in May 2021 and informed consent was received from each study participant, I scheduled a 60-minute semistructured Zoom (a cloud-based video-conferencing platform) meeting or telephone conference calls with each confirmed STEM female participants. Over a period of three weeks, the 16 interviews were completed in a private office space in my home, that was free of distractions and family interruptions. The length of each individual interview was less than the scheduled 60 minutes that was initially planned, and instead, interviews lasted between 20 to 40 minutes due to participants' limited availability within the time zone of their specific geographic region and new in-person work schedules assigned after the COVID-19 pandemic stay at home order ended (see Table 4).

When all the virtual online interviews and telephone interviews were completed with the participants from the month of May 2021 to June 2021, I transcribed the audiotaped narratives verbatim and exported the data into a Microsoft Word table and saved them in a document file to prepare for member-checking, data coding, and the analysis process.

Table 4

Interview Dates and Length of Individual Sessions

Participant	Assigned Alphanumerical Pseudonym	Interview Date	Total Length of Interview
1	Er01	5/14/21	20 minutes
2	Ez02	5/15/21	25 minutes
3	Ow03	5/16/21	26 minutes
4	Ey04	5/16/21	22 minutes
5	An05	5/24/21	20 minutes
6	Ns06	5/24/21	40 minutes
7	Gh07	5/24/21	21 minutes
8	On08	5/25/21	31 minutes
9	An09	5/25/21	33 minutes
10	Ll10	5/25/21	34 minutes
11	Ad11	5/25/21	28 minutes
12	Vy12	5/25/21	29 minutes
13	Es13	5/29/21	37 minutes
14	Li14	6/7/21	24 minutes
15	Yd15	6/7/21	21 minutes
16	Re16	6/8/21	29 minutes

The transcribed interviews were saved as individual transcripts in a Microsoft Word file on a password-protected personal computer to conduct the member checking step and feedback. Each participant was contacted by email and forwarded their individual interview transcript as an attachment. This important step gave each person the opportunity to review the transcript and identify any needed editing, corrections, or revisions relative to their individual interview transcribed verbatim, and provide feedback (Patton, 2015). Overall, participant member-checking was completed within a reasonable timeframe (2-weeks), and there were no recommended grammatical changes, revisions, or editing requested by the participants to improve the accuracy of the transcript.

The 16 original interview transcripts remained the same, and to evaluate the individual characteristics amongst the study sample, the collected demographics were compiled and reported in a table format for review (see Table 3). To protect the confidentiality of the participant's identity, an alphanumerical pseudonym was assigned to each person in place of their true names on all digital and hard copy printed documents that I prepared for the study.

Data Analysis and Thematic Coding Process

To prepare for the data analysis process, the audiotaped interviews were transcribed verbatim into text format for examination of the collected individual narratives. I then read and reread the collected transcripts several times to begin the three critical steps outlined by Al-Jaghoub et al. (2010) to simplify the data reduction process and identify a point of thematic saturation. The steps included: (1) data reduction, (2) data display, and (3) data verification. Considering the aim of this qualitative study, Al-Jaghoub and colleagues described the first step, data reduction, as a procedure that starts before the data collection step. In this first step, *data reduction*, involved the researcher reviewing the P-E Fit theoretical conceptual framework multiple times prior to reviewing the data extracted from the verbatim interview transcripts.

Conceptually, P-E Fit theory is defined as “the congruence, match, or similarity between the person and environment (Edwards, 2008, p. 168). Essentially, the P-E Fit theoretical model posits that the organizational fit between individual differences and the environment is strained when there is a discrepancy or incongruence between the two critical elements (Mackey et al., 2016). Theoretically, if the two constructs are perceived as compatible, there is congruence and a sense of job satisfaction, which eventually results in an optimal P-E fit. Previous studies related to workplace issues have found that it is natural for individuals to seek work environments and careers that are compatible with their personality, vocational needs, and future career goals (Chan & Huak, 2004;

Mackey, Perrewe, & Mcallister, 2016). It should be noted that this view aligns with the study's purpose, which was to explore the impact of the male-dominated work environment on the well-being of STEM women and discuss their personal experiences in the petroleum and O & G sector and other STEM workforce fields.

Step two is *data display*, and it involved reading and reading of the interview transcripts and researcher written notes to identify possible preliminary themes from the collected interview data to make sense of the information that will be used to reach conclusions in the final chapter of this study. As for the third and final step d*ata verification*, the focus was conducting member checking with each study participant to first verify the accuracy of the verbatim interview transcript generated from the interview protocol prior to data analysis. For this step, each informant that participated in this qualitative study was emailed and given the opportunity to review the interview transcript data and verify if the captured text was correct, incomplete, or in need of revisions.

With P-E Fit as the theoretical frame of reference, each of these steps were conducted prior to examining and color-coding the emerging and recurring word patterns, quotes, shared perspectives, and phrases to simplify the collected raw data and make sense of the individual responses expressed by the STEM women. As part of the data analysis step, each transcript was printed and read by the researcher, then reflective notes and codes were recorded in the side margins of the printed hard pages. These, handwritten comments extracted from the first and second reading of the individual transcripts included comments pertaining to work related stress, gender barriers, organizational resources, emotional support, mental health, career advancement, and role demands in the built environment. The recurring statements, observable behaviors, facial expressions, and word choices used by the women were color-coded by assigning different colors on the digital version and printed copies to highlight certain words and verbal statements.

For example, (1) feeling overwhelmed, stressed, and overworked; color coded with *blue*, (2) perceived gender inequality; color coded with *purple* highlight, (3) perceived masculine design; color coded with *yellow* highlight, (4) counseling and taking personal time was color coded with *light blue* highlight, (5) receiving friend and family support; color coded with *green* highlight, and (6) exercising: physical fitness; these highlighted quotes indicated that the STEM women were trying to maintain their mental health and the color *gray* was used for coding.

Once the data reduction, data display, and data verification steps were completed, the next step involved organizing the preliminary and emerging data themes, grouping the color-coded themes, and categorizing the information to make it more understandable to readers. To perform the first and second level of thematic coding, labels and codes were applied to the organized information and saved in a Microsoft Word table format (see Table 5). This phase made the collected data more manageable in preparation for the third level of data analysis and understandable to the researcher. Notably, Van Miegroet et al's. (2019) recommendation regarding incorportaing written reflection notes taken in real-time with each interviewed participant was applied and included in the table for the initial analysis step and third-level coding process.

Table 5

Summary of Codes and Preliminary Themes: Level One and Two

Interview Protocol Questions	Initial Codes	Collapsed Codes/ Preliminary Thematic Patterns
1. How do you define occupational stress?	1. Feeling overwhelmed and overworked 2. Stress due to job responsibilities 3. Long working hours causes stress 4. Not able to sleep and poor eating habits 5. When you can't meet required deadlines and become frustrated 6. Feeling Overwhelmed 7. Very Stressful work environment 8. Lack of career advancement for women that want to become leaders in male-dominated environments 9. Job causing stress 10. Psychological stress caused by the job 11. The job causing anxiety 12. When you are judged unfairly by the supervisor because you're a women 13. Gender inequality as a barrier to career advancement 14. Feeling anxiety 15. Workplace pressure 16. personal safety is not secure in the field	1. Overwhelmed 2. Overworked 3. Feeling Stress 4. Sleep problems 5. Gender inequity 5. Long work hours 6. Safety concerns 7. Diet and poor eating habits
2. What work situations do you find stressful in the STEM work environment?	1. Lifting and working with heavy equipment 2. Feeling overwhelmed by the pressures of the job and poor working conditions 3. Not having the proper tools or training to perform the job 4. Micromanagement 5. New company policies and procedures that do not improve the job or the safety of your job and receiving sexist comments by co-workers 6. Lack of career resources for women 7. Poor work schedules for moms with families 8. Lack of consideration 9. Causing one to feel they don't belong based on gender and assuming they can't perform the job as good as a man because they're a women 10. Not receiving equal treatment as a women 11. Being mistreated because you're a women 12. When adequate training is not provided 13. Long work hours 14. Attending staff meetings and not having a voice because you're a woman or input is ignored or not validated by the group 15. Poor communication between the supervisor and staff can cause accidents	1. Working with heavy equipment 2. Inadequate training 3. Communication 4. Threats to your job 5. Unequal treatment 6. Not having a voice in meetings 7. Few career opportunities due to gender

	16. Threats to your job	
3. Describe how you feel about the quality design of the built environment in the engineering field? How does it affect your overall sense of well-being?	1. It is efficient, and I feel secure in the workspace 2. Design caters to men and can be overwhelming at times 3. Not enough resources available to accommodate women engineers 4. It is designed for men and can be mentally overwhelming 5. Another STEM field might have a better aesthetics/or work environment 6. Aesthetics do not cater to my gender 7. Does not feel comfortable and has no time to socialize 8. I love the design of my work environment, but women are not treated equally in the work environment 9. I had to be creative and think outside the box and find ways to get the job done despite the quality of the work environment 10. Aesthetics makes me feel tired and miss home 11. It is masculine and not inspiring 12. Aesthetics/design caters to the male gender 13. As a civil service (government employee) technician, the aesthetics are sterile and has no color; non-inspiring but men are comfortable with the military design 14. Not sure how it affects me 15. I chose a STEM career, so I knew what to expect 16. I Don't know how I feel	1. Not a problem 2. Not sure how I feel 3. Sterile 4. Masculine design 5. Not inspiring 6. No sleeping area for women in the field 7. Male design affects my mental health
4. What self-care services or mental health resources do the organization provide employees as a tool to help manage occupational stress and maintain a healthy work-life balance?	1. Online counseling 2. Employee counseling by referral from the supervisor 3. Not much available, and I will be negatively stigmatized if I complain to the supervisor 4. No resources provided 5. Scheduled days off for mental health reasons 6. Free counseling provided for employees 7. Counseling if you have the time to meet 8. Nonavailable 9. HR provides virtual counseling, stress resources, a hotline if you need to talk, and provides a list of external counseling services if needed 10. A recreation center to work out; that's it 11. No resources that I know of; not informed 12. Yoga 13. HR offers individual counseling and mental health workshops. Self-referral is acceptable 14. HR takes women's mental health seriously 15. Live chat counseling services are available if needed 16. I have not been informed of any services	1. Individual counseling, but you are stigmatized if you request services 2. I talk with friends and family 3. None offered 4. Use exercise area 5. Yoga classes 6. HR stress management group seminars 7. Personal time off

5. What coping mechanism do you practice to care for your physical health and overall mental well-being in the current workplace and to manage occupational stressors (e.g., anxiety, time pressure, depression, stress)?	1. Meditation and prayer and massages 2. Exercise; doing Pilates 3. Talking to friends and drinking wine 4. Prayer and remain private 5. Ask for help if I need it, talk to family members, and use patience when there is a change in the work environment 6. Use my sick time 7. Eat healthier and prayer 8. Maintain a personal life outside of work and take care of myself 9. Remain honest with myself and be prepared to work harder because I'm a woman in a male-dominated field 10. Breathing exercises and practice meditation 11. Play video games and take mental health breaks, such as long drives 12. Meditation 13. Prayer and individual counseling for work-related situations 14. Facetime with friends and family 15. Talk with friends and alcoholic beverages 16. Mind my own business	1. Meditation 2. Prayer 3. Healthy eating 4. Take relaxation time 5. Spend time with family and friends 6. Video games 7. Personal counseling 8. Work out
6. Were you recruited for employment in the oil and gas industry or another STEM field, or did you seek STEM job opportunities in this field because of your educational background or specialized skills	1. Recruited in the O & G field 2. Recruited because of my educational background 3. Recruited 4. Both-Recruited and searched for jobs in this field 5. Recruited 6. Sought out this field because of the high pay 7. Recruited 8. Sought out this field because it matched my work experience and educational background 9. Sought out this field because of the high salary 10. Sought out this field due to education in the sciences 11. Recruited in engineering because I was a woman, and the pay was higher than other career fields 12. Recruited for the field 13. Pursued this field because of the higher salary 14. Higher income made me seek STEM jobs 15. Recruited by a close friend 16. I chose a STEM education, and a company recruited me	1. Recruited 2. Sought STEM job due to high salaries 3. Education prepared me for a STEM career 4. Prepared for STEM field; had an interest in the sciences and math as a teen

Finally, before moving to the third level of analysis, it was critical to search for meaning in the organized and grouped data by examining information related to the (a) verbatim interview data, (b) frequently spoken words, (c) perceptions, (d) quotes and phrases, (e) work conditions and environment, (f) interpersonal interactions, (g) supervisor and social support, and (h) work experiences. The third level coding step involved systematic coding and further collapsing of significant and recurring expressed words and phrases recorded in the chart. This process entailed reviewing the sub-codes and recurring themes while maintaining a focus on the connection to the P-E Fit theory throughout the data analysis process.

Themes

The resulting thematic codes generated from the interview data were generated through the final extraction coding process with respect to answering the two research questions. The interview data collected from the 16 semistructured interviews were thematically categorized and color coded to answer the two research questions and four sub-questions. Key phrases, quotes, perceptions, observed gestures, word usages expressed by the participants, and my observational reflective notes were read several times and then analyzed to understand the first-hand experiences of the STEM women employed in the petroleum sector and other STEM careers.

In a review of the collected data with the 16 participants, it was revealed that data saturation occurred after the 13th interviewee due to the repetition of similar or same descriptive words used, distinct verbal statements, perceptions, personal thoughts, and phrases expressed in response to the interview protocol questions. The final extracted themes drawn from the analyzed interview data resulted in six core themes. They include: (1) overwhelmed, stressed, and overworked, (2) gender inequality, (3) masculine design, (4) counseling and taking personal time, (5) friends and family support, and (6) exercise: physical fitness (see Table 6).

Table 6

Research Questions and Core Themes

Research Question and Sub-Questions	General Core Themes	Codes
RQ1: How do STEM women describe their work experience in the oil and gas built environment or other related STEM settings, and how do these perceived experiences affect their physical, mental, and social well-being in the STEM industry? **RQ 1 Subquestions:** 1. What are the perceived daily challenges experienced by women working in the oil and gas workplace environment or other STEM fields? 2. Do the design characteristics of the workplace-built environment affect their behavior, mood, or mental health?	**RQ1 and Subquestions** Overwhelmed, overworked, and stressed Gender inequality Masculine design and workplace safety **Subquestions 1 and 2** Masculine design Sterile and not inspiring	Feeling overwhelmed and overworked at work Being judged unfairly by your supervisor because you're a women Psychological stress caused by the job Personal safety is a concern in the O & G field The design caters to men and can be mentally overwhelming It is masculine and not inspiring Not sure how I feel
RQ2: What strategies do women employed in the oil and gas industry or other STEM fields use to manage occupational stress related to the ecological environment of the oil field worksite or corporate office setting? **RQ 2 Subquestions**: 1. What work situations do women perceive as stressful regarding the oil field drilling site or other male-dominated STEM fields? 2**.** What professional services or helping resources are available to employees in the organization to help reduce self-perceived stress or anxiety	Counseling and taking personal time off Friends and family support Exercise: Physical fitness **Subquestion 1** Safety **Subqquestion 2** Individual counseling HR stress management group resources and seminars	Take personal time off Talk with friends and family A recreation center to work out; that's it Free counseling provided for employees Poor communication between the supervisors and staff can be dangerous HR provides virtual counseling, stress resources, a hotline if you need to talk, and provides a list of external counseling services if needed

Results for Research Question 1

The purpose of this research question and sub-questions was to understand the difficulties that STEM women confront in male-dominated built environments and if it affected their psychological well-being. The first research question is the following: *How do STEM women describe their work experience in the oil and gas-built environment or other related STEM settings, and how do these perceived experiences affect their physical, mental, and social well-being in the STEM industry?*

Subquestion 1 ($SQ_1$1):

1. What are the perceived daily challenges experienced by women working in the oil and gas workplace environment or other STEM fields?

2. Do the design characteristics of the workplace-built environment affect their behavior, mood, or mental health?

The following themes generated for research question one were: Overwhelmed, stress and overworked, gender inequality, workplace safety. The multiple themes for the sub-questions (masculine design and sterile, and not inspiring) are discussed within the context of the discussion for research question one.

Overwhelmed, Stressed, and Overworked. This core theme emerged when the participants were asked to define the meaning of occupational stress. Instead, they personalized the concept and described how the term applied to them within the workplace setting. As a result, 8 of 16 informants described occupational stress as causing feelings of anxiety, frustration, pressure, feeling overwhelmed and overworked due to long hours, and being treated differently by supervisors and peers because they were women. This was a real concern for those with an interest in remaining in the STEM field and pursuing future leadership roles within their firm.

Another response related to defining occupational stress explained how stress negatively impacts women by causing unwanted anxiety and pressure. Participant 12 stated, "I feel anxiety" in the workplace linked to project deadlines and pressure. Likewise, participant 11 stated, "this causes psychological stress on the job."

Gender Inequality. Participant 9, commenting on gender inequality, said that,

> "When you're a woman working in a male-dominated field can be challenging. There isn't much room for career advancement, which can be stressful for a lot of women who want to work their way up the career ladder and become a boss."

Also, on the issue of gender inequality, workplace stress, and safety, participant 5 was very candid and stated,

> "Occupational stress is something that will never improve for women. Job security, fairness no matter your age, race, and gender, are also issues that will not improve. There is high management turnover, and personal safety is not a concern when it comes to the bottom line."

***Masculine Design*.** A high number of participants commented that the male-dominated built environment catered to the male gender and did not represent interior designs that appealed to women. Participant 13 commented that the built environment is "masculine and non-inspiring." Further, participant 14 that worked with the government as a civil servant, said,

> "it is a sterile design; military-oriented design. I work in a cubicle that is non-inspiring. Males are more comfortable with the design; it has no color and is a basic environment. But it does not impact my mood because I decorated my assigned workspace."

However, by contrast, participant 1, who worked in the O & G field, expressed a different view regarding the STEM workplace. She said, "it is at least efficient and effective; it makes me feel secure." Thus, suggesting that the basic design is typical of the O & G industry and meets the needs of the employees. As a result, the oil patch (oil field) has the equipment and tools needed to perform the job efficiently. Interestingly, two participants were indifferent and did not have a descriptive comment to share on how the built environment affected them. This may suggest that they are not impacted by the STEM environment, and there are no psychological implications.

Results for Research Question 2

The second research question focused on what strategies STEM women used to cope with stressful conditions or challenges in their science-related role in a male-dominated workplace and how these strategies attributed to their well-being and competence. Thus, the second research question is the following: *What strategies do women employed in the oil and gas industry or other STEM fields use to manage occupational stress related to the ecological environment of the oil field worksite or corporate office setting?*

Subquestion 1 ($SQ_1 2$):

1. What work situations do women perceive as stressful regarding the oil field drilling site or other male-dominated STEM fields?

2. What professional services or helping resources are available to employees in the organization to help reduce self-perceived stress or anxiety?

The core themes derived from the data analysis for research question two are counseling and taking personal time, Friends, and family support, and Physical and Spiritual Fitness. The themes identified for the two sub-questions (safety, individual counseling, and stress management group seminars) are discussed within the context of the discussion for this second question on coping strategies and resources used by STEM women.

Counseling and Taking Personal Time. In describing the coping strategies used to manage and maintain their overall well-being and psychological health, five of the participants commented that meditation and prayer were important to managing daily stressors. Participant 11 commented that "I do breathe exercises and meditation and prayer," while Participant 4 stated, " I pray, but I also mind my own business to avoid stress." In terms of taking personal time to relax, participants 6, 8, and 11 shared that taking time away from work helped them cope with workplace stress. As an example of the actual activity, participant 6 shared, "I take long drives and play video games."

Participant 4 spoke about how helpful HR is in helping employees cope with environmental stressors. She stated the following "That's what I love best about this career." In this statement shared by participant 4, she is emphasizing that the helping resources provided by the HR department are a great benefit for coping with inter-office stress. When discussing the specific available coping resources offered, participant 4 then stated,

> "When it comes to our well-being and mental health, our HR department takes it very seriously. They provide us with so many different resources depending on the situation. We can have a live online chat session with someone, and there is a hotline for those that are a talker. They provide us with brochures for nearby facilities if additional counseling services are needed."

Friends and Family Support. In discussing the topic of receiving support from family members and friends, four of the participants expressed that having support from family members was useful to managing stress. Participant 5 described the emotional benefit of having family support and how positive communication helps with adjusting to daily challenges in the workplace:

"Healthy living and being organized, asking for help, spending family time, and having patience with change in the workplace is not bad. Having that someone to talk to that you can trust gives you a moment to breathe and exhale."

Participant 9 described her coping mechanism as accepting the realities of the job and staying motivated by working hard to advance in her career. She said,

"I cope with occupational stress by being honest with myself. I understand that I'm in a male-dominated industry, so I'm prepared to work a little harder for my recognition and to work harder for career advancement." In general, her comment took a different direction in contrast to some of the other participants. Her objective view inferred that she is self-motivated and does not need the support of family and friends to help her excel in her STEM role. Also, the culture of the workplace climate does not affect her and fits her career goal, which aligns with the P-E Fit theory.

Physical and Spiritual Fitness. Some participants commented that eating healthy, getting massages, practicing yoga, Pilates, and utilizing the on-site recreation room helped them manage workplace stress. Three of the participants expressed that they engage in exercise to cope with stress rather than seek mental health counseling services. Participant 3 stated that "I fear that I will be negatively stigmatized if I complain about the workplace conditions and request counseling services." In the case of the above comment , this may suggest that she has an awareness of certain gender biases in this male-dominated built environment and is fearful of retaliation from the leadership team. However, what is not clear is if this same belief is shared or observed by the men in the workplace. When I followed up with a probing question to gain more clarification on her thought, she was not sure if men felt the same way nor if the other women in the company shared the same viewpoint. She replied that "it was mainly her thinking about the issue."

Evidence of Trustworthiness

To ensure the trustworthiness of the collected data for this qualitative research study, which explored the lived experiences of 16 STEM women, the evaluative process reflected four foci: credibility, confirmability, transferability, and dependability (Lincoln & Guba, 1985; Mertens, 2005). In summary, credibility relates to maintaining trust in the research findings to produce the accuracy of the collected data. As for confirmability, Lincoln and Guba (1985) formally defined confirmability as the ability of the researcher to remain objective during the data collection process to avoid producing bias data. To achieve transferability, this encompasses being able to generalize the results or findings to other qualitative studies. Conceptually, dependability refers to the ability of the researcher to generate reliable data that can result in an accurate and clear understanding of the phenomena under study (Anney, 2014).

Credibility

Generating a creditable output in the scientific results of a study involves researchers collecting rich and accurate data to develop an in-depth understanding of the research phenomenon. This research study employed a qualitative research design; thus, throughout the implementation process, which included conducting individual interviews online due to the global COVID-19 pandemic, the data collection process, and data analysis, it was important to desensitize myself from the personal and professional experiences of the STEM respondents as the themes emerged from the interviews and researcher's hand-written observational notes. To aid in this analysis process, the digitally audiotaped interview sessions helped the researcher remain more objective and thorough during the data collection phase of this study.

Moreover, the use of bracketing helped to gain a better understanding of the phenomenon under analysis (Evans et al., 2018; Hesser-Biber, & Piatelli, 2012). To aid in strengthening creditability, I examined the final transcription of each interview and read it several times to confirm that the results reflected the accuracy of the respondents' perceptions and spoken words and not mine. Later member-checking was conducted by emailing the interview transcripts to each participant to verify the accuracy of the collected narrative data. During the data analysis procedure, before finalizing and reporting the significant or core themes and subthemes found in the semistructured interview data and researcher's observational and reflective notes, I made sure data saturation had occurred before concluding additional color-coding of the data was no longer necessary to discover new information.

Confirmability

Confirmability suggests that the results from the study are objective and unbiased, meaning the findings are not reflective of the researcher's own personal views (Patton, 2015). Therefore, in this study, to generate a degree of trustworthiness in the research process, close attention was focused on obtaining quality and untainted viewpoints from the interviewees during the interview and data collection process, which means that the research findings are a reflection of their (interviewees') personal thoughts, professional experiences, and emotions and not those of the researchers. In addition, from the onset of the interview process, I used self-monitoring and bracketing as research strategies to remain consciously neutral and mindful of any pre-conceived held assumptions related to the professional and personal experiences shared by the interview participants.

Transferability

Transferability is considered synonymous with the research terms reliability and external validity used in quantitative studies (Anney, 2014). The term transferability suggests that the findings from one study can be applied to another study with a similar research sample and contextual research setting (Patton, 2015). As discussed in Chapter 3 the methodology section, I recruited a total of 16 STEM women that met the research criteria, which was: (1) identify as female; (2) work full-time or part-time (25 hours a week) in a male-dominated STEM industry; (3) have at least one year or more of employment tenure in the STEM workforce; (4) work in the built environment such as an office building setting or in the field in a STEM-related occupation; and, (5) have personal experience (past or present) or knowledge of the STEM work environment and onsite workplace interactions. According to Patton (2015) transferability of a qualitative study is demonstrated by the researcher providing readers with an accurate interpretation and description of the transcribed interviews verbatim. This provides evidence that the findings can be generalized to other contextual settings and study populations.

Therefore, to demonstrate transferability to the readers or other researchers interested in repeating the STEM women’s study, I performed member checking to verify that the interview transcripts were informed by the viewpoints of the participants, and it was an accurate reflection of the interview exchange between the researcher and the participants. Additionally, to make certain that the collected data was accurate to the best of my ability, I performed descriptive coding on the raw response data until I reached a point of data saturation and categorized the emerging themes, subthemes, and verbal patterns to find meaning in the results (Patton, 2015).

Dependability

Similar to confirmability, dependability is conceptually equivalent to the term reliability in quantitative research and refers to the ability of the researcher to generate reliable data that can result in a clear understanding of the phenomena under study (Anney, 2014). For this study, dependability was demonstrated by employing a standardized interview protocol (procedures) to guide the planning and execution of this qualitative study. This planning design included using the recommendations outlined by Runeson and Host (2009). They purported that the research design and implementation of a research plan should include the following steps: (1) A research design and approach (study objectives, interview protocol, saturation); (2) Data collection sources (identify multiple data sources for information); (3) Analysis of the data (meaning applied to the collected data through coding and categorization of themes); and, (4) Implications for practice that may be useful to the research community and practitioners studying the STEM topic.

Chapter Summary

In Chapter 4, a summary of the results was presented, which consisted of raw interview data generated from participant responses to the semistructured interviews, designed with open-ended questions. The focus of the study was to explore the phenomenon, which was exploring the well-being of STEM women working in the gendered built environment of the petroleum industry and other male-dominated STEM settings. The data analysis process for this study entailed reviewing the collected interview data, thematic color-coding, categorizing, and organizing of the data using statistical and data analysis software. NVivo, SurveyMonkey response sorting tools, and hand coding were used to conduct and confirm the thematic color-coding and categorizing of the data and interpretation of the findings.

The in-depth thematic color-coding of the data analysis helped to identify frequently used words, emergent themes, and verbal patterns derived from the recorded open-ended interviews with the 16 respondents until data saturation was reached for the phenomenon under consideration. From the data analysis, after completing the coding step, the three core thematic categories for research question one and the sub-questions are identified as (1) overwhelmed, overworked, and stressed; (2) gender inequality, and (3) masculine design. The three core themes identified for research question two and the sub-questions are (1) counseling and taking personal time, (2) friends and family support, (3) physical and Spiritual Fitness. The thematic pattern of keywords supported the logic of the P-E theoretical framework, which posits that a person-environment fit or matching alignment with the work environment can either predict the attrition of employees if the work setting is not perceived as a good fit or the comfort one feels in the physical workspace, which can result in the retention of STEM women.

In the next section, Chapter 5, an interpretation of the study findings based on the phenomenological design are discussed, and recommendations are offered to other researchers exploring the well-being and retention of STEM women employed in STEM related careers. The discourse and conclusion relative to the implications of the findings are also discussed in the next chapter to aid employers and other researchers on how to improve the recruitment, retention, and well-being of STEM women that currently remain underrepresented in traditionally male-dominated STEM career fields.

Chapter 5: Discussion, Conclusion, and Recommendations

Introduction

This qualitiative study explored the mental health effects of the built environment on the well-being and retention of professional women across age, employed in male-dominated professions connected to the physical sciences, technology, engineering, administration, and math-related workforce. Although the representation of women employed in STEM careers has increased, they remain disproportionately underrepresented in comparison to men across ages and ethnicity in all the STEM fields (Yanosek et al., 2019).

Studies have suggested that the inequitable sex-based differences are particularly higher in the O & G upstream and downstream STEM fields than in any other built environment (Rick et al., 2017; Williams et al., 2014). These differences are particularly evident when considering the number of women that leave the profession mid-career (i.e., after age 30; Glass et al., 2013) because they are overlooked for promotions or leadership positions (glass ceiling effect; Williams et al., 2014), experience implicit and explicit gender biases (Osborn & Kleiner, 2005), and are paid lower occupational wages in comparison to their male counterpart (DiPrete & Buchmann, 2013).

For the purpose of this research study, the term-built environment as defined earlier by Dearry (2004), is used to refer to the material, spatial, cultural, and social activities of human labor. Furthermore, the positive influences linked to the physical characteristics and supportive ecological conditions of the workplace are associated with optimizing or improving the mental and physical wellness (e.g., physical, mental, and social relation outcomes) and job satisfaction of employees (McCay et al., 2017; Simon & Amarakoon, 2015). Wells et al. (2010) and Chenoweth (2015) posited that the specific elements associated with the built environment, such as ambient conditions related to ceiling height, spatial dimensions, lighting, thermal heating of buildings, and social interactions, can either positively or negatively impact a sense of well-being and public health perception, which affects one's overall work experience.

The purpose of the present qualitative study was to explore how the built environment relative to the masculine culture of the O & G field (i.e., office positions, drilling rig services, engineering, supplies, distribution, exploration, and production units) impacts the mental and physical well-being of women, who are understudied in the growing body of research on the retention and advancement of women employed in STEM occupations. The discourse on the significance of the study findings, presented in chapter 5, may lead to new retention strategies and interventions to help mitigate the attrition of professional women working in the O & G field and in other STEM careers.

The conclusions drawn from the data analysis may address the void in the literature on the mental health issues that adversely affect STEM women in the petroleum sector and other related built environments. As a result, the findings of the study may help to improve the understanding of how the gendered workplace settings in STEM fields pushes women out prematurely in comparison to their male counterparts in STEM careers. In this final chapter, the results and significance of the findings, a summary and interpretation of the results, the limitations, and recommendations for future researchers studying gendered STEM subjects are presented, and the implications of the study results are discussed in detail.

Inclusion Criteria for Study Participants

For this study, the required inclusion criteria to participate as a potential study sample included the following: (1) identify as female; (2) work full-time or part-time (25 hours a week) in a male-dominated STEM industry; (3) have at least one year or more of employment tenure in the STEM workforce; (4) work in the built environment such as an office building setting or in the field in a STEM-related occupation; and, (5) have personal experience (past or present) or knowledge of the STEM work environment and onsite workplace interactions. To recruit 16 qualifying participants for the qualitative single-gendered study, convenience (i.e., a nonprobability technique used to conveniently or purposively recruit participants), and the snowballing sampling technique (i.e., word-of-mouth network referrals by participants in the study), were used to target STEM women employed in various science and engineering fields. This included job roles/or positions in senior or middle-level management, finance and accounting, human resources, engineers, clerical personnel, oil rig operators, and office administrators that have worked for at least 1 year in the O & G industry or another STEM related field.

Due to the current COVID-19 public health pandemic, all the scheduled interviews were conducted virtually using a videoconferencing platform and telephone conference calls. Using a semistructured interview format with open-ended questions, each of the 16 respondents were asked six interview questions, and the collected narrative data were audiotaped and transcribed, then uploaded to a Microsoft Word file to prepare for the data analysis procedure, interpretation of data, and reporting of the research findings. The collected data gathered from the individual interviews were saved on the researcher's personal password-protected computer along with the returned informed consent confirming their participation in the study.

To protect participant identities throughout the study, complete anonymity was maintained by assigning each individual an alphanumerical pseudonym, as an identifier, on all documents connected to the research study. Prior to conducting the individual interviews, a brief electronic demographic survey was sent to participants to collect descriptive background information related to age range, educational level, marital and parental status, family size, ethnicity, full-time or part-time employee, leadership, or no-leadership position, tenure in the STEM field, and access to stress-relieving resources in the workplace.

Overview of the Key Findings

To perform the data analysis, step an in-depth thematic color-coding data analysis and management processes was used to identify frequently used words, emergent themes, and verbal patterns derived from the audio-recorded qualitative interviews with the respondents. With a focus on uncovering the perceived experiences expressed by STEM women in the male-dominated built environment, there were five preliminary composite themes derived from the data analysis for the first research question. They were (a) overwhelmed, overworked, and stressed, (b) gender inequality, and (c) workplace safety. For the *second research question,* the six dominant themes were identified as (a) counseling, (b) taking personal time off, (c) exercise, (d) safety, (e) individual counseling, and (f) stress management group seminars. As a result, the final six core themes were identified as the following: (1) feeling overwhelmed, stressed, and overworked, (2) gender inequality, (3) masculine design, (4) counseling and taking personal time, (5) friends and family support, and (6) physical and spiritual fitness.

Research Questions and Sub-Questions

The research study was guided by the following research questions and subquestions:

Research Question 1 (RQ1): How do STEM women describe their work experience in the oil and gas-built environment or other related STEM settings, and how do these perceived experiences affect their physical, mental, and social well-being in the STEM industry?

Subquestion 1 ($SQ_1$1): What are the perceived daily challenges experienced by women working in the oil and gas workplace environment or other STEM fields?

Subquestion 2 ($SQ_2 1$): Do the design characteristics of the workplace-built environment affect their behavior, mood, or mental health?

Research Question 2 (RQ2): What strategies do women employed in the oil and gas industry or other STEM fields use to manage occupational stress related to the ecological environment of the oil field worksite or corporate office setting?

Subquestion 1 ($SQ_1 2$): What work situations do women perceive as stressful regarding the oil field drilling site or other male-dominated STEM fields?

Subquestion 2 ($SQ_2 2$) What professional services or helping resources are available to employees in the organization to help reduce self-perceived stress or anxiety?

Interpretation of the Findings

Research Question 1 and Subquestions

The purpose of the first research question and subquestions was to understand the difficulties that STEM women confront in male-dominated built environments and if it affected their psychological well-being. The identified themes for this first question were (a) overwhelmed, stressed, and overworked, (b) gender inequality, and (c) masculine design. The theoretical lens for this qualitative investigative study was P-E Fit which is postulates that "the congruence, match, or similarity between the person and environment (Edwards, 2008, p. 168). In the organizational business literature, researchers have found that employees are directly affected by the physical and social characteristics and the spatial conditions inside the workplace, which can lead to complex physical health problems or psychological distress if there is perceived incongruence (Dias et al., 2016; Van Vianen, 2000). The study's theoretical framework, the P-E Fit theoretical framework, helped to gain new insight on the different experiences and the socioemotional impact of the built environment on the 16 STEM women.

Most of the participants in the study perceived that the male-dominated workplace environment catered to men, meaning that the aesthetics of the STEM setting and underrepresentation of women, especially in leadership roles, had a positive effect on men and a negative effect on STEM women. For example, one participant explained that in the oil patch, some O & G fields do not have designated sleeping quarters for women. As a result, women either slept in their cars or at a nearby hotel for the workweek. Here, drawing on the role of environment and gender, this experience supports an incongruent P-E Fit as it relates to creating an environment that supported the gendered needs and well-being of women in the oil field.

Further, this personal experience protects the masculine-built environment and perpetuates gendered biases toward women in the field. In this case, the emergence of the core themes associated with the first research question plays an important role in understanding how women maintain their motivation and psychological well-being through coping resources and strategies. Activities such as receiving individual or group counseling, taking personal time off, and engaging in self-help activities such as exercising provided the stress relief needed to persist in an unequal masculine work climate were noted by the research subjects.

The research findings also revealed some of the unfavorable organizational experiences affecting STEM women in the built environment were associated with feeling overwhelmed, long working hours, and gender related inequalities. Participants 8 and 13 stated that although they liked their jobs, gender biases and mistreatment were evident when it came to organizational leadership support. For example, some women shared that during staff meetings, input shared by women was ignored by their male counterparts, thus suggesting that their voices or ideas were not important or accepted by the administrative hierarchy and colleagues. As a result, this impacted their psychological well-being, and studies have found that long-term experiences such as this can lead to lower job satisfaction and demonstrate a lack of organizational fit and commitment to the organization (Cech & Blair-Loy, 2010; Richard, 2018).

Other situations perceived as unfair treatment were linked to a lack of career opportunities, receiving inadequate skills training, and mentoring support from administrators to help them (women) advance within the firm. Long work hours were also viewed as problematic by some of the informants. They expressed that they were unable to sustain a healthy work-life balance and nutritious diet due to mandatory overtime and long working hours. For most of the informants, having a personal network of family and social support was considered an important protective barrier against the emotional pressures and physical challenges related to feeling overwhelmed and overworked in the traditional male-dominated work culture. In earlier STEM studies on former women engineers, it was found that work-life balance issues induced thoughts of leaving the organization (Fouad et al., 2017; Hunt, 2016; Taylor, 2016). For example, in a sample of female engineers, Hunt (2016) and Fouad et al. (2017) found that the following factors influenced their decision to leave the STEM career field: (a) high work demands and inflexible workplace culture, (b) lack of organizational support, (c) deficient career advancement opportunities, and (d) failure to provide access to a mentorship program.

Research Question 2 and Subquestions

For the second research question, it focuses on coping strategies used by STEM women to manage stressful conditions in the male-dominated workplace and the challenges associated with their job roles. How these strategies attributed to their overall well-being was also explored to gain insight into their assumptions. The extracted themes identified for the second research question were: (1) counseling and taking personal time, (2) friends and family support, and (3) physical and spiritual fitness. All 16 participants addressed these questions and shared that they used different coping strategies to manage stress in the workplace. Four of the participants described how prayer and meditation were helpful in addressing perceived stress. One participant said "eating healthy and prayer" was important to maintaining her overall health. Three participants stated that practicing meditation was beneficial for maintaining a positive attitude.

Alternatively, one participant shared that "my way of relieving stress is playing video games and taking long drives; this is relaxing for me." Interestingly, Participant 9 held a different viewpoint and line of reasoning in response to coping mechanisms to promote well-being. She said, "I cope with my occupational stress by being honest with myself. I understand that I am in a male-dominated industry, so I was prepared to work harder for my recognition and to work extra harder for career advancements." This statement reflected the opposite of the other qualitative remarks and suggested that she expected a dominant masculine environment and a "good old boy social network and structure." Perhaps she was unaffected by these challenges in the male-dominated culture because she felt modifying or changing the culture of the built environment was out of her control.

She made it clear that she chose to enter a STEM profession, and it is up to her to make adjustments to fit into the organizational climate. Theoretically, she consciously deemphasized the science and gender incongruence issues. Instead, consistent with the P-E Fit logic, she recognized the explicit importance of persisting in the male-dominated climate to remain on her career path. Her remark suggests that she has a science identity and feels connected to her STEM job role. Conceptually, these comments support a P-E Fit, implying that when individuals feel good about their work environment, that indicates a match between the person and the workplace cultural climate.

Significance of the Study

While there has been improvement in recruiting and retaining women in different STEM-related fields (NSF, 2017), certain STEM areas such as the O & G field and computer sciences have made little progress in increasing the percentage of talented STEM women in these core employment sectors. The research findings gathered in this qualitative study from participant feedback indicate that women continue to leave STEM careers at a higher rate than their male counterparts. The specific experiences connected to influencing and perpetuating gender biases and inequality for women employed in the STEM sector related to the following concerns: (a) a lack of support and mentoring, (b) gender stereotypes, (c) lack of career advancement, (d) male-gendered hierarchical social structure, and (e) masculine workplace climate.

Moreover, the masculine aesthetics of the environment makes women feel uninspired, as if they do not belong in the environment or they are not a good fit. However, with higher salaries for STEM-related jobs and interest in the sciences, these women chose to remain in STEM fields and are satisfied with their jobs, despite the challenges within the environment. As one participant expressed,

> "I love the quality design of my work environment. I wish more people understood the equality that goes with the design and that it is a woman's career choice, so we should be on the same level as men in this career field."

Essentially, she is invested in her career, and although the male-gendered climate is challenging at times, that will not disrupt her career path in the field.

Another participant pointed out that

> "my overall experience has made me learn to think outside the box. It made me figure out other alternatives to get my job done in a safe way and on time. However, if women had the same opportunities as males, the job would be much easier to perform."

These comments note that environmental stressors were related to traditional gender biases, which could be less problematic if women were treated equally to men and not assumed to have a skill or knowledge deficit. The significance of the findings for the current study highlights that although the women benefited from receiving individual counseling, exercise and recreational activities, meditation, and daily prayer, their narratives support the need for firms to invest in more robust gender-equitable initiatives to alleviate gender discrimination. Such efforts would include forming collaborative relationships with STEM women advocacy organizations to explore how firms could create a gender-free work environment and implement practical reforms to dismantle the hierarchical male environment that contributes to psychological stress and women deciding to leave the STEM field mid-career or change careers to a non-STEM profession.

Limitations of the Study

As stated earlier, limitations are viewed as potential weaknesses connected to the validity of a research study (Patton, 2002, 2014). For this qualitative study, the first limitation pertains to using only women as the targeted sample. Because of their low representation in the STEM workforce, recruiting a single-gender female sample may become problematic in securing a broad and representative sample from specific STEM fields. To address this particular shortcoming and secure an adequate sample size of participants, additional outreach techniques such as expanding the recruitment net of women employed in other states will be employed and starting the recruitment process a year or six months in advance.

Another limitation is that the findings may reflect personal and professional gendered views as they relate to women working in the sciences and technology-built environment, which can limit the transferability and generalizability of the results to other occupational STEM and non STEM job fields. The last potential limitation is related to interviewees having certain beliefs regarding the O & G industry culture or other STEM fields. As a result, these beliefs attributed to their personal lived experiences and workplace challenges may communicate gendered-oriented obstacles that are not experienced by men.

Recommendations for Future Studies on STEM Women

To increase the literature on STEM women working in traditionally male-dominated career fields, such as the O & G industry and technology field, future researchers should explore the person-fit connection that starts with the organization's commitment to gender equality and early outreach related to STEM women persisting in the sciences at the collegiate (various internships) and professional level. This targeted focus is needed if historically male-dominated STEM fields are to grow and make progress in recruiting and retaining women in the petroleum-built environment and other male dominated STEM workplaces that reflect a masculine cultural space. For future researchers studying this important gendered topic, they may want to incorporate certain self-reported demographic attributes or information in their analysis and to determine if age differences, marital status, education attainment, and tenure in the STEM field is linked to a woman's ability to overcome the socioemotional challenges, and social isolation linked to the underrepresentation of women employed in STEM professions.

Thus, the following research and practitioner-related recommendations are presented to address these concerns regarding the well-being and gender inequality that have resulted in the lower representation of professional women entering and remaining in STEM fields.

1. Future research studies should focus on understanding how professional STEM women with long-term tenure in the O & G industry or other STEM fields have persisted and advanced to leadership roles in their careers.

2. Researchers should focus on exploring the role and effectiveness of human resources counseling services and examine how their assistance can be further used to increase the representation, retention and career persistence, leadership development, and social integration of women working in male-dominated STEM work environments.

3. Research on national STEM organizations should focus on what type of supportive services are needed to influence STEM women to stay in their profession, and not leave their careers to pursue non-STEM careers.

4. To improve the person-environment relationship and the well-being of STEM women in male-dominated built environments, organizations should seek survey input from STEM women and female leaders on what specific internal resources and physical changes are needed in the setting to improve their sense of belonging and commitment to the O & G petroleum sector and other non-medical STEM industries.

Implications of the Study Findings

This research study using a qualitative approach to focus on how the built and ecological workplace environment affects the well-being and retention of STEM women in the O & G and other STEM fields uncovered the complexities that impact STEM women. With reference to the study's implications, this study contributes to the expansion of the present literature on the recruitment and retention of STEM women and the adverse environmental factors that lead to an early departure from their STEM careers. In addition, this study identified some of the barriers and negative workplace conditions and interactions that result in career stagnation for STEM women interested in advancing to a leadership position within the STEM workplace.

Poorly enforced policies, leadership practices, and masculine conditions are some of the factors expressed by the interviewees that promoted gendered-related stereotypes and workplace stress for women working in the O & G and other STEM settings. This study highlighted the type of proactive climate, holistic HR support programs, and self-help resources needed to reduce self- isolation, improve a sense of mental and physical well-being, and sense of job satisfaction among STEM women. The first-hand experiences and feedback shared by the STEM women in this study can be used to inform and guide managers on the importance of perception regarding workplace aesthetics and environmental design. One participant noted that the workplace environment was not inspiring, masculine-oriented, and sterile, thus suggesting that it could have a negative effect on her mental health. The research findings also produced a serious discourse on the historical barriers connected to the "old boys club mentality" and traditional leadership pathways that are closed to women in the sciences, thereby creating a leaky or empty pipeline of STEM women, who remain under-represented in many male-dominated built environments. By uncovering these structural and manufactured gender barriers that hinder career advancement and job satisfaction for STEM women, organizational managers, and human resources should collaborate and offer strong advocacy and mentoring programs to lift the inequitable barriers that are historically designed to maintain a societal status-quo system of male domination in STEM fields.

Conclusion

By increasing the number of STEM women in the workforce, the technical fields and engineering sectors are able to address the persistent gender gap and stereotypical biases that help to maintain a male-dominated gender hierarchy in the math and sciences. The contribution of this study is that it not only addressed the literature gap on the mental health concerns that adversely affect STEM women employed in the petroleum sector-built environment and other fields, but it broadens the discourse on the gendered culture in STEM fields and, in particular, the O & G field that pushes women out mid-career or induces professional burnout (Settles, 2014). Given the importance of the STEM field, replication of this research study using a larger target group of women may further the understanding of the built environment and facilitate effective retention strategies that mitigate the attrition of experienced women working in STEM and college women majoring in core STEM fields (Carnegie Mellon University, 2016).

To increase the number of STEM undergraduates and allied professionals in the future, the physical environment, and interactive workplace culture must profoundly change to recruit new talent leaving the engineering and technical academic pipeline and entering the workforce (Beam, 2016). In the case of employee productivity in STEM work environments, studies have suggested that if organizations addressed the adverse trajectories associated with the gendered STEM organizational environments, the high attrition of women might decrease and make the field more gender-balanced (see, e.g., Avey et al., 2009; Dias et al., 2016). In general, if employers want to effectively secure talented, competent, and healthy employees trained in the STEM fields and prevent high turnover, they must develop a healthy and fair workplace climate to prevent and reduce built environmental and occupational stressors that hinder the success of STEM women in all areas of the gendered workplace environment (Vainio, 2015; Van Vianen, 2000).

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Appendix A: Recruitment Invitation Letter

Greetings,

My name is [redacted], and I am a doctoral student at Walden University's School of Psychology Program. With institutional approval from Walden University (IRB #04-22-21-0346460), **I am seeking your participation in a dissertation study that explores the overall well-being of STEM women working in the oil and gas field or other related STEM fields (non-medical).** The title of the academic study is "Built Environment and Well-Being of STEM Women Employed in the Petroleum Sector." The research study intends to explore how the quality conditions, interactions, and aesthetics of the workplace affect the psychological health and well-being of STEM women.

To participate in the study, you must: (1) Identify as female; (2) Work full-time or part-time (25 hours a week) in a male-dominated STEM industry; (3) Have at least one year or more of employment tenure in the STEM workforce; (4) Work in the built environment such as an office setting or in the field in a STEM occupation; and, (5) Have personal experience (past or present) or knowledge of the STEM work environment and onsite workplace setting. If accepted to participate, this study involves the following steps:

- Complete an Informed Consent process
- Complete a demographic survey
- Participate in individual audiotaped virtual interviews using Zoom or WebEx video conferencing platform.

Your participation in this study is entirely voluntary, and you may withdraw at any time without any penalty. Also, the results of the study are kept private; thus, there is no identifying information shared on data collected from participants.

If you have questions or comments regarding the research study, I can be contacted by email. By participating in this research study, you may help to improve the understanding of the concerns regarding the STEM work environment, mental health support, mentoring, and other collective experiences that impact the retainment and psychological outcomes of underrepresented women working in male-dominated STEM fields. Thank you for your time.

Respectfully Yours,

Natalie Robinson, Doctoral Student
Walden University

Appendix B: Demographic Profile Survey

Built Environment and Well-Being of STEM Women

Directions: Please check the appropriate response to each background profile question listed below.

1. Age Range:

18- 25	☐
26-33	☐
34-41	☐
42-49	☐
50-57	☐
58 or over	☐

2. **Marital Status**: Single ☐ Married ☐ Widowed ☐ Divorced ☐

3. Parental Status (Family Size): 1 to 3 children ☐ 4 to 5 children ☐ 5 or more children ☐ No children ☐

4. Ethnicity: White ☐ Black or African-American ☐ Hispanic or Latino ☐ Asian or Pacific Islander ☐ Indian ☐ Middle-Eastern ☐ African ☐

5. Highest Level of Educational Attainment

High School	☐
GED	☐
Bachelors	☐
Master's Degree (Advance Degree)	☐
Doctorate: PhD or EdD	☐

6. Employment Status: Full-Time ☐ Part-Time (at least 25 hours) ☐

7. Length of Tenure with your Current Employer

Less than 5 years	☐
Between 6-10 years	☐
Between 11-15 years	☐
Above 16 years	☐

8. Tenure in the STEM Industry: Years of experience in a STEM field

Less than 5 years	☐
Between 6-10 years	☐
Between 11-15 years	☐
Above 16 years	☐

9. For *Managers and Supervisors*: Years of experience working in a supervisory role

Between 1-5 years	☐
Between 6-8 years	☐
Between 9-10 years	☐
Above 11 years	☐

10. Number of Employees (under your supervision or leadership)
Between 1- 3 ☐
Between 4-10 ☐
Between 11-20 ☐
Above 21 ☐
11. **Do you work more than 40 hours a week**: ☐ Yes ☐ No
If yes, how many hours of overtime do you average weekly
Between 0-3 hours
Between 4- 5 hours ☐
Between 6-7 hours ☐
Between 8-10 hours ☐
Between 11 hours or more ☐
12. Does the workplace provide stress relieving resources: ☐ Yes ☐ No ☐ Yes, but I don’t have time to participate due to my work schedule

Appendix C: Semistructured Interview Protocol

Thank you for agreeing to participate in this study as an interviewee on the well-being of STEM women working in the petroleum and oil and gas industry. The purpose of this study is to explore the well-being of women, which is associated with concerns related to occupational stress, anxiety, and job burnout. Additionally, the helping resources that resulted in your retention in the STEM petroleum sector will also inform the results of this study. The interview will last approximately 60 minutes, and if you are uncomfortable with a particular question, you can choose not to answer the question without disclosing the reason why.

The six interview questions are the following:

1. Were you recruited for employment in the oil and gas industry or another STEM field or did you seek STEM job opportunities in this field because of your educational background or specialized skills? Probing question: (a) Was salary a critical factor in deciding to work in this STEM sector? (b) What were your initial thoughts or concerns about working in a male-dominated industry?

2. How do you define occupational stress? Probing question: (a) Think about some of the challenging situations that you have experienced in the current workplace.

3. What work situations do you find stressful in the STEM work environment? Probing question: (a) Reflect on work situations that you typically find stressful in the present or past work situations relative to the male-dominated workplace; it could be the present employer or another firm.

4. Describe how you feel about the quality design of the built environment in the engineering field? How does it affect your overall sense of well-being? Probing questions: (a) Describe how the design of the worksite, the employee provided housing, and office building affects your behavior, attitude, mood, or physical health, (b) Explain if you feel comfortable, happy, satisfied, stressed, or frustrated in the current workplace environment.

5. What self-care services or mental health resources do the organization provide employees as a tool to help manage occupational stress and maintain a healthy work-life balance? Probing question: (a) Reflect on any personal or professional services that are available and promoted by the organization to help employees experiencing stress or anxiety.

6. What coping mechanism do you practice to care for your physical health and overall mental well-being in the current workplace and to manage occupational stressors (e.g., anxiety, time pressure, depression, stress)? Probing questions: (a) What self-help strategies do you use to maintain your physical and mental health and explain why you feel “they are or are not” effective in maintaining your health and controlling stress-related responses, (b) does the organization provide e-mail counseling, face-to-face counseling, time off or formal or informal group talks (i.e., lectures) on stress management and wellness topics?