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Investigating the Factors Contributing to the Underrepresentation of Female Lecturers in STEM Disciplines at a TVET College

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ABSTRACT
South Africa has prioritized science and technology studies as key sectors for national economic growth. Despite the increasing importance of science, technology, engineering, and mathematics (STEM) education in today's world, gender disparities persist in these fields. This study aims to examine the underrepresentation of female lecturers in STEM fields at a technical and vocational education and training (TVET) college in South Africa. STEM education in TVET colleges has the potential to support innovation, productivity, and economic development, yet women remain underrepresented due to ingrained biases that deter them from pursuing STEM-related careers. The study employs a theoretical framework based on social cognitive theory and gender stereotype threat, examining how gender stereotypes affect perceptions of capability and impact career choices. An active case study research design was used, involving one-on-one interviews with male and female lecturers, followed by three focus group sessions with lecturers and female engineering students. The analysis shows that gender stereotypes are prevalent in this context, with participants indicating that these stereotypes and associated biases are ingrained from an early age, shaping career decisions. The study findings reveal that gender norms and systemic barriers continue to hinder women's success in academia within the TVET sector.

KEYWORDS
Artisans; equality; gender stereotype; self-concept; STEM subjects; TVET colleges.

INTRODUCTION AND BACKGROUND

Science and technology studies have been designated as priority development areas in South Africa (Mathews et al., 2000) due to the critical role of producing future scientists and engineers who can actively contribute to a global society that advances science, which is essential for any nation's economic development (Archer et al., 2015). Some studies show that women are increasingly represented in science, technology, engineering, and mathematics (STEM) professions globally after graduation, significant disparities exist (Fry et al., 2021; Yeh, 2018).

This study focuses on understanding why women are less likely to pursue careers in STEM fields, particularly within STEM-related studies and occupations. While numerous studies have examined the underrepresentation of women in STEM professions (Abo Hamza et al., 2024; Ranson, 2005; Hatmaker, 2013; Herman, 2015; UNESCO, 2015), and many universities' STEM departments have been investigated to determine why female students are underrepresented and often abandon these courses (Graham, 1997; Griffith, 2010; Gumpertz et al., 2017; Savaria & Monteiro, 2017), there has been limited research on the causes of the underrepresentation of female lecturers in STEM subjects at technical vocational and educational training (TVET) colleges globally (Christie et al., 2017; Khan et al., 2017; Matabane et al., 2022). This study complements prior research but specifically aims to examine why fewer female lecturers teach STEM subjects in TVET colleges in South Africa, with a particular focus on a selected TVET college in Gauteng.

- At this engineering campus, within the NCV streams (2021), there are 40 full-time lecturers who do not hold management positions, comprising 25 men and 15 women. In the National Accredited Technical Education Diploma (NATED) stream, all 20 lecturers are men. Globally, women are underrepresented in STEM fields, yet there is a gap in the literature regarding the reasons for this underrepresentation from women's perspectives. Notably, no research has specifically examined this issue within the TVET sector in South Africa. This study aims to address this gap. The objectives of this study are as follows: To investigate the factors that motivate female lecturers to enroll in STEM study fields and eventually teach STEM subjects at the TVET college, as well as the reasons why some female lecturers choose to pursue studies in non-STEM-related fields.
- To identify the obstacles that female lecturers must overcome to pursue and sustain a career in teaching STEM subjects.

The study aimed to analyze gender dynamics within the classroom and their impact on female participation in engineering through discussions with male and female lecturers and students. This analysis was intended to inform the creation of a more inclusive and supportive learning environment. The research was conducted at an engineering campus in Gauteng, involving one-on-one interviews with male and female lecturers who taught NATED and NCV courses. Additionally, focus group sessions were held with various participants to explore these dynamics further.

LITERATURE REVIEW AND FRAMEWORK

Gender inequalities in STEM institutions of higher learning

Babalola et al. (2021) claim that gender bias, prevalent in various organizations and across societies, undermines justice and hinders many women's aspirations to become leaders, whether in higher education institutions, science, technology, or other fields. They also highlight that women's acceptance and participation in science, technology, and leadership roles remain limited, with only 12 of the 117 universities in the Southern African Development Community having women in leadership positions among STEM researchers across North, West, East, and Southern Africa. Their study findings reveal that gender discrimination is one of the most important challenges faced by women leaders in STEM. Participants described gender discrimination as men making derogatory remarks, experiencing insubordination from male colleagues, and being excluded from critical decision-making processes.

1. TVET has been praised as "the answer to the skills shortage and skills mismatch in Africa and the missing link for the training and integration of youth in the labor market" (Bray-Collins et al., 2022, 151-152). While TVET holds significant potential for expanding employment, fostering economic development, and ultimately empowering young Africans, questions remain about how effectively TVET institutions can contribute to the social changes necessary to achieve the sustainable development goals (SDGs) on the African continent, particularly in terms of altering oppressive gender dynamics (Buthelezi et al., 2024; Chauke, 2023; Nkambule & Ngubane, 2023). Bray-Collins et al.'s (2022) literature review, "Gender and TVET in Africa," suggests that TVET institutions on the African continent often reinforce patriarchal dynamics rather than serve as sites of transformation due to a lack of gender-responsive reforms grounded in an understanding of how "gender regimes" function. Their literature review highlighted three critical themes: Gender is often given lip service in grey literature but lacks systematic research and theorization. Moreover, there is a weak connection between gender and TVET studies and African feminist or African postcolonial scholarship.
2. TVET organizations and services are deeply gendered, mirroring the broader sociocultural dynamics of the societies in which they operate. These patriarchal sociocultural dynamics create systems of gender inequality by weaving together sociocultural, political, and economic ties. Research indicates that TVET institutions not only reflect but also actively perpetuate societal gender patterns.
3. In the absence of gender-responsive reforms aimed at addressing the root causes of inequality within TVET institutions on the African continent, these institutions tend to reinforce gender inequalities rather than serving as potential sites for transformation.

Barriers to women's experience in STEM

Scientific innovation is essential for a nation's economic competitiveness, quality of life, and national security in today's globalized world, and the STEM fields are projected to see substantial employment growth in the future (Dasgupta & Stout, 2014). While gender

differences in mathematics and scientific achievement have been narrowing, important disparities persist in STEM self-concept and aspirations. Even when girls and women outperform their male counterparts in STEM tests, many lose interest and choose not to pursue STEM courses or careers, leading to a loss of potential talent among those who could become the next generation of scientists, engineers, and technological innovators (Abo Hamza et al., 2024; Dasgupta & Stout, 2014). Dasgupta and Stout's (2014) research on gender differences in STEM found that the causes of these disparities vary across different life stages, with distinct factors affecting gender gaps in childhood and adolescence compared to adulthood. They elaborate on these reasons as follows: In childhood and adolescence, girls tend to avoid STEM fields due to masculine stereotypes associated with STEM, parental expectations for their daughters, peer norms, and a perceived lack of alignment between STEM careers and their personal goals. In emerging adulthood, women often avoid STEM majors or leave courses prematurely due to feeling like a misfit in STEM classes, being vastly outnumbered by male peers, and the absence of female role models.

In early to mid-adulthood, factors such as subtle gender bias in hiring and promotion, biased evaluation of scientific work, a non-inclusive working climate, the challenge of balancing work and family responsibilities, and difficulties returning to work after having children contribute to the reduced retention of women in STEM fields.

The main aim of this investigation is to explore the relative underrepresentation of female lecturers in STEM disciplines at a TVET college, an institution of higher learning. Bystydzienski and Bird (2006) examined the barriers women face in higher education, noting that the U.S. higher education system was originally designed by and for elite men, leading to the persistence of traditionally masculine values such as hierarchy, challenge, competition, and independence. These values are particularly entrenched in male-dominated fields like physics, computer science, and engineering. Bystydzienski and Bird argue that many women find the culture and organization of these “male” fields to be hostile and exclusive. In their work, Removing Barriers: Women in Academic STEM, they contend that a systemic barrier for women in these fields is the expectation that researchers must devote themselves entirely to scientific investigation, to the exclusion of all other aspects of life. This expectation assumes that those who are serious about their work will prioritize it above everything else, making women who seek a balance between science and other life responsibilities appear unfit for a scientific career. Historically, many male scientists have relied on spouses to manage household and childcare responsibilities, enabling them to focus entirely on their research. However, as more women enter scientific careers, many are unwilling to forgo motherhood, instead seeking to balance both career and family life. Interestingly, this desire for balance is also becoming more common among young men entering science. Despite these shifting attitudes, both men and women continue to face academic expectations that create important strain, particularly during the early stages of their careers, when many women are likely to be bearing children.

Social cognitive theory

To understand the underrepresentation of female lecturers in STEM subjects at TVET colleges in South Africa, it is essential to explore how gender experiences affect individuals' occupational choices. According to social cognitive theory, particularly in the context of gender development and differentiation, children learn to define themselves as male or female as they develop cognitively (Blose & Ndlovu, 2023). Bussey and Bandura (1999:696) state that "one's gender status could determine not only dress and play, but occupations pursued, and functions performed in family life" once self-categorization occurs. It is important to note that self-categorization emerges from a society that emphasizes gender distinctions. The theory suggests that boys and girls acquire substantial knowledge about gender-appropriate behavior through cognitive processing and experiences. In social situations, these cognitive processes highlight gender disparities in perceived capacities, reinforcing the belief that men and women have inherently different abilities.

Women who pursue traditionally male careers, such as engineering, are often viewed negatively in the workplace compared to women in stereotypically female occupations. They are frequently perceived as inadequate in these roles due to receiving less support from mentors and peers (Bussey & Bandura, 1999). Although women's roles have evolved in recent years, socio-structural practices have lagged behind, allowing those who benefit from existing structures to entrench their privileges through protective organizational processes. This slow shift in organizational practices particularly disadvantages women in traditionally masculine occupations, where they are often deemed less competent than their male counterparts and excluded from important networks and activities (Bussey & Bandura, 1999). Gender socialization plays a role in this disparity, as men are encouraged to develop attributes associated with competence and achievement in preparation for paid employment, with a focus on mechanical, technical, and mathematical skills (McIlwee & Robinson, 1992). In contrast, while women may envision themselves in future careers, their socialization continues to emphasize family roles. McIlwee and Robinson (1992) highlight these differences by comparing the professional lives of female engineers in the USA with those of their male colleagues.

Gender stereotype threat

The term "gender stereotype threat" refers to the phenomenon where individuals, particularly women, experience anxiety or underperform in situations where there is a risk of reinforcing negative stereotypes about their gender. This concept is based on the premise that cultural assumptions about gender roles and abilities can create psychological pressure, leading individuals to doubt themselves and perform poorly in certain situations or professions. Psychologists Claude Steele and Joshua Aronson first introduced the idea of stereotype threat in 1995, primarily focusing on racial stereotypes and their impact on academic performance. Subsequent research expanded the concept to encompass gender stereotypes as well.

According to Spencer et al. (2016), when members of a stigmatized group find themselves in situations where negative stereotypes could be used to interpret their behavior, the fear of

being judged based on those stereotypes can lead to disruptive actions, ultimately harming their performance and aspirations in that field. Rather than attributing gender gaps to women's individual preferences—whether perceived as socialized or "hard-wired"—Betz, Ramsey, and Sekaquaptewa (2013) claim that research on stereotype threat challenges us to reconsider how we understand these disparities. Stereotype threat suggests that environmental factors, rather than inherent preferences, may be more responsible for these gender gaps. It exemplifies how unexpected circumstances can affect how women and girls behave, pursue their interests, and perceive themselves.

According to Smeding (2012), stereotypes have the power to undermine women's and girls' self-perceptions of their abilities, performance, and even their motivation to pursue careers that do not align with traditional stereotypes, such as those in masculine fields. These stereotypes are ingrained early in childhood through regular socialization rather than direct learning or experience. It is argued that such stereotypes affect the cognitive development of students, affecting how they interpret constructs, attributes, and role-taking, which in turn has significant implications for their self-concept (Igbo et al., 2015).

RESEARCH DESIGN AND METHODOLOGY

Research design

The research design is an active case study, which is well-suited for this study as it aims to explore the experiences of the limited number of female lecturers teaching STEM subjects and to understand, through participant discussions, why they chose this career path. This design also captures the experiences of women at the college who did not pursue careers in STEM subjects and their reasons for doing so. Male lecturers were also included in the sample, providing valuable insights and contributing to the development of guidelines aimed at encouraging more women to teach STEM subjects at TVET colleges in South Africa.

Sampling

The study was conducted at the engineering campus of a TVET College in Gauteng, involving a diverse group of participants. One-on-one interviews were held with male and female lecturers, some teaching in the NCV stream and others in the NATED stream, and focus group sessions were conducted with groups of participants, all of whom volunteered for the study. The one-on-one interviews included five female NCV lecturers, four male NATED lecturers, and three male NCV lecturers. After these individual interviews, the lecturers volunteered to participate in focus group discussions. The first focus group comprised nine lecturers: five female NCV lecturers specializing in both STEM and non-STEM subjects, two male NCV lecturers, and two male NATED lecturers, as there were no female lecturers in the NATED stream. The second focus group included six female engineering students and three male lecturers (two from NCV and one from NATED), with one male lecturer also part of the initial focus group. Female students from Level 3 Automotive Repair (2) and Level 2 Plumbing (4) volunteered to join this group after being informed about the study. The final focus group consisted of six female engineering

students (four from the second focus group) and three female lecturers. Efforts were made to achieve a gender balance, a balance between the NATED and NCV streams, and a mix of STEM and non-STEM lecturers in the selection of participants for these focus groups.

Instruments and data collection techniques

The data collection methods included in-depth interviews and focus groups with the selected participants. The interviews were conducted as one-on-one sessions with the lecturing staff, using semi-structured interview guides to steer the conversation.

Data analysis and interpretation

The data from the interviews were collected, organized, and categorized into patterns, leading to the identification of themes emerging from the interpretation of the data. The first step involved open coding of the individual interview data, where codes were created by assigning meaning to the array of data. These codes were then categorized into clusters to further refine and reduce the data. Through thematic analysis, patterns in the data were identified and developed into themes. This interpretation was validated with participants via a member-checking process (Anney, 2014; Guba & Lincoln, 1994), allowing them to review the synthesized account and ensure that all essential aspects were accurately captured and nothing significant was overlooked.

Data interpretation was conducted within the framework of theories relevant to the study, including those cited in the literature review. Specifically, the analysis considered gender role implications and gender stereotyping, which encompass widely shared and accepted beliefs about men and women (Gupta et al., 2009; Eagly & Karau, 2002).

The same process was applied to the focus group material, beginning with open coding, followed by categorization, and culminating in thematization. However, in this case, rather than focusing on individual statements made by participants, I analyzed the dynamics of the group discussion, paying close attention to the flow of conversation, as recommended by Duggleby (2005).

Ethical considerations

Ethical clearance was obtained from the university prior to the commencement of fieldwork, and permission was granted by the TVET college to conduct research at the institution. Participants who volunteered to be part of the study provided written consent and were comfortable with voice recordings. As they were all above 18, they were required to sign consent forms and were informed of their right to discontinue participation at any time without obligation. Participants were assured of their right to anonymity and confidentiality, with no names or identifying personal information recorded for public use to protect their identities. To enhance trustworthiness, data were collected through in-depth interviews and group discussions, which were digitally recorded with participants' consent. Triangulation was incorporated in this study by contrasting the data and themes from the in-depth interviews with those from the focus groups. Triangulation, which involves using multiple methods, investigators, sources, and theories to collect corroborating evidence, helps reduce bias and

verify the consistency of participants' responses (Anney, 2014).

FINDINGS AND DISCUSSIONS

Impact of gender stereotype on young children

"Can the presence of gender stereotypes undermine women and girls even when men and women appear to be treated equally?" ask Betz et al. (2013:428). They argue that for a stereotype threat to be effective against a certain group, it is sufficient merely to be aware that others might endorse it. This awareness alone can affect behavior, interests, and self-perception in women and girls, illustrating how even seemingly equal treatment can be undermined by the subtle power of stereotypes. In this study, 11 out of 12 participants in the one-on-one interviews acknowledged the existence of gender stereotypes, while one participant felt that such stereotypes did not exist. After the majority confirmed the presence of gender stereotypes within the engineering field, they were asked about the potential impact of these stereotypes on women in STEM, given the study's objective to examine the motivation behind the relative underrepresentation of female lecturers in STEM disciplines at a TVET college. Three participants stated that these stereotypes have a detrimental impact on young girls and suggested that these stereotypes often originate from certain household environments.

> *"…I want to believe the stereotype is more, not at a national level… But it comes from homes and smaller clusters back there. So, when you grow up in such an environment, your mind will definitely be affected."*

He went on to explain.

> *"We may not like it, but there are situations where families where a girl child is treated less than a boy child, even the opportunities like being sent to school and isn't that still disadvantageous to them?" (LectN4).*
>
> *"There are women who grew up in households where they are not allowed to do certain subjects, so that is a social issue, where parents hinder their children from doing certain subjects and ending up becoming even nurses, and not even teachers, taking more feminine careers… To brothers being doctors and engineers, so there is that gender stereotype in the homes." (LectF3).*
>
> *"I think, uh… on the stereotype questions…it's our culture… it's our different cultures… the African culture… it's supposed to be a man thing… you understand? So maybe some of these things, it's because of the practices of our culture in the way they see things, rather than to give an opportunity to anyone, so I think… basically our culture does have an impact on those things." (LectNCV4).*

The participants' remarks align with the findings of Bray-Collins et al. (2022), who argue that TVET organizations and services are deeply gendered, reflecting the broader sociocultural dynamics of the societies in which they operate. These patriarchal sociocultural dynamics create networks of social, political, and economic connections that sustain systems of gender

inequality. According to their research, TVET institutions not only mirror but actively contribute to the reinforcement of societal gender norms. This is consistent with the social cognitive theory of gender development and differentiation, where Bussey and Bandura (1999) argue that a person's gender status affects not only attire and play but also career choices and family roles, emphasizing the importance of self-categorization in cultures that prioritize gender distinctions. The results of this investigation validate and support these theories. Additionally, research by Dasgupta and Stout (2014) claims that in childhood and adolescence, masculine stereotypes about STEM and parental expectations of daughters, among other factors, deter girls from entering STEM fields—a pattern also evident in the findings of this study.

Stereotypes in STEM classrooms

According to Smeding (2012:617), stereotypes can undermine women's and girls' self-perceptions of their abilities, performance, and even their aspirations to pursue careers that defy traditional gender roles, such as those in masculine fields. These stereotypes are ingrained early in life through regular socialization rather than direct learning or experience. It is suggested that these stereotypes affect the cognitive developmental changes in students, shaping how they interpret constructs, qualities, and shifts in role-taking, which in turn impacts their self-concept (Igbo et al., 2015).The results of the study clearly show that these engineering students encountered gender stereotypes related to their career choices and the field of study they chose to pursue. *"One guy asked me where I school and asked, "How are you gonna do it because it's a man's job? I asked, 'Where was it written that it is a man's job? Are you not educated enough about the whole thing?' I didn't take it personally because I knew what I wanted" (PlumL2.1).*

> *"Back at high school, people used to call us dumb because we did Drawing (Technical Drawing) … we were the only girls doing it at school… and its only men doing it. Nelson Mandela fought for us to be equal… I felt bad because they said it's only men who do that thing… At first, I doubted myself because others had said that" (AutoL3.1).*

The study participants detailed various gender stereotype experiences they encountered in STEM classrooms, with some openly discussing the confusion and self-doubt these stereotypes instilled in them as they worked to succeed in their careers. These experiences align with the findings of Dasgupta and Stout (2014), who argue that in emerging adulthood, women often feel like misfits in STEM classes, are vastly outnumbered by male peers, and lack female role models, leading them to avoid STEM majors or drop out prematurely.

Impact of gender stereotype in the workplace

This study found that gender stereotypes had several detrimental effects on women in the workplace: women felt judged and were told they could not pursue a career in science; their inputs and contributions were often overlooked; they felt sidelined and denied opportunities for advancement; and they were concerned that their family life would be jeopardized if a balance between family responsibilities and career was not effectively achieved and managed. During the one-on-one interviews, when asked about the social barriers that prevent women from pursuing careers in STEM disciplines, two female participants who taught STEM subjects

expressed that women were often judged and told, "they can't do this." *"But I think there are fewer women because they're afraid that they're not really what it is. They fear of… that they're not capable… Like…. Obviously, you're already judged when you are a lady. You're already judged…. Oh, she's in a workshop… no wonder the students are failing... She, she's putting on nails, do you think she can even combine a cupboard… those kinds of things? So you're already judged on… based on how you dress based on how you look…. Never- those students will never pass carpentry… those students will never pass Building…. whatever, how can she put bricks together and all those, I think they are already judged… the fear of being judged " (LectF2).*

> *"It actually starts before coming to TVET it is that outside… outside the TVET colleges… already women are being told that they cannot do this hence there are fewer women teaching such subjects" (LectF1).*

The responses from these two lecturers align with the findings of Spencer et al. (2016), who claim that when members of a stigmatized group are placed in situations where unfavorable stereotypes may be used to interpret their behavior, the fear of being judged according to those stereotypes can lead to disruptive behavior, ultimately harming their performance and aspirations in that field. Apart from feeling "judged," the lecturing staff participants in the one-on-one interviews indicated that within the working environment of STEM disciplines, the inputs and contributions made by women were often not recognized. One participant, drawing from her experience as a metallurgist at a previous workplace, explained:

> "*Yeah, the stereotype definitely exists because even when you are there, since it's a very male-dominated industry, they don't listen to you compared to a guy. So even their response to me was not the same as a guy gave them orders. So, I think it does. So, I felt it didn't give me… I couldn't grow. I couldn't grow" (LectF2).*

One of the male participants described how women were treated in some STEM-related industries, particularly those classified as male-dominated, stating:

> *"Again, it's a male-dominated industry. And then they don't have much say, even if they comment on meetings and so forth... Even when they have some ideas... they don't take it into consideration because it's a woman" (LectN1)*

According to Bussey and Bandura (1999), women who pursue traditionally male vocations, such as engineering, are often perceived unfavorably in the workplace compared to those in traditionally female occupations. They typically receive less guidance and support from mentors and peers, are often deemed incompetent, and are excluded from informal networks and activities. This study revealed that women in these industries are not encouraged, as their contributions are frequently undervalued. Moreover, they are not supported, as they are often sidelined or marginalized in the workplace, as evidenced by the participants' responses. Four participants felt that women were sidelined and not given opportunities to fully execute their duties or grow in STEM-related career paths. One female participant, who had worked as a fitter and turner before transitioning to teaching at the college, responded as follows when asked what could be done to encourage more women to pursue careers and teach STEM subjects:

"You know, for example, an in… in industries, they will tell you that you can't use the forklift, why you can't pick up such a heavy metal or whatever the case may be, give, give opportunities so that you can see if we are really capable, let me do it. Let me prove to you that I can do it. Now, we are not given enough opportunity to actually prove ourselves that we can actually do this…." She further explained:

> *"When you are at school, they actually train us to be in those sectors. So, when we get to industries, we are already trained to be in those sectors. So I don't understand why we are not given an opportunity, whereas you were already trained to do such a thing. You know…" (LectF1).*

One participant was asked about his view on the impact of gender stereotypes on women. He responded as follows: *"Programs around the community… Nothing is said about STEM, the programs that are there are mainly male-dominated… they talk about men can do this, men can do that…nothing is said about the women, the women are being sidelined, they are not given the opportunities, they are not being encouraged, and this creates a big taboo… it's a taboo amongst the community…we must also include women."(LectNCV2).*

Participants described how women were excluded from opportunities, sidelined during crucial decision-making processes, and even treated with contempt in various STEM industries. This experience aligns with a study by Babalola et al. (2021), where female leaders at African universities reported gender discrimination, including insubordination by male co-workers and being sidelined during critical decisions. Similarly, participants in this study expressed that women are often sidelined in STEM careers. During the interview, a participant shared that she felt her family life was threatened while working as a metallurgist before transitioning to teaching Mathematics at a TVET college. She recounted her experiences at her previous job with an engineering company, describing the challenges she faced during that time.

> *"Okay, like, let, since I'm a lady. Let's say there was a time when I was pregnant… See, it's a male-dominated place, so it affected me, I felt like, okay, maybe I shouldn't take maternity leave. Because in this place, there isn't a lot of men who take maternity leave, what if I leave and then they just say, Okay, since she's taking a lot of maternity leave, maybe it's just better if she just leaves, you know, those kinds of things, they come into your mind, because you are in an industry where people don't even take maternity, but I'm here, I'm taking maternity leave. So, what should I do? Should I sacrifice, not having a family over my career, those kinds of things? They affect, you know" (LectF2).*

One of the male lecturers provided the following input: *"I think one of the barriers for the staff… in terms of women, you may realize that as well we… I think most of the responsibilities in either bringing up your family, in terms of the chores that need to be done in the family, and then you will find that most of the time, they then have to split their focus between work and home. And engineering in itself is a demanding field. So, to balance the time, you'll find that a lot of women, even though they have the capability, that's what I think even though they have the capability they will end up shifting away to create time for other things for*

family and other things. Leave the engineering field, which then you will find has become male-dominated. And that's actually quite bad. How do we address that? I think that the work environment needs to change and also there's got to be training on men as well on our side, to be able to do the things that women do… you know to be available to women so they can do what they want in terms of engineering stuff " (LectN5).

The experiences and arguments shared by the participants align with Bussey and Bandura (1999), who assert that despite important changes in women's roles, socio-structural practices have not kept pace, particularly in traditionally masculine occupations. Women in these fields are often perceived as inadequate compared to their male counterparts. This viewpoint is supported by Bystydzienski and Bird (2006), who argue that the perception that those who prioritize their employment above all else are more committed creates a structural barrier for women in male-dominated organizations. Consequently, women who seek to balance their professional and personal lives are often deemed unfit for these roles. Bird (2010) recommends that instead of trying to change women to fit the demands of science and engineering, institutional systemic barriers should be removed to fully integrate women into STEM careers and organizations. This issue is also evident in the STEM classroom, where female engineering students must navigate the balance between family responsibilities and academic demands, as social norms often dictate that women are the primary caregivers. McIlwee and Robinson (1992) argue that gender socialization helps men develop traits associated with achievement and competency, particularly in mechanical, technical, and mathematical skills, in preparation for paid employment. However, while women may aspire to careers, their socialization still places a strong emphasis on family roles.

CONCLUSIONS

Numerous participants in this study believed that gender stereotypes are harmful to girls and that these prejudices often stem from family traditions. They felt that these stereotypes affect female career choices and future decisions. This aligns with the findings of Bussey and Bandura (1999), who noted that gender status can impact not only attire and play but also career paths and family roles. These factors may contribute to why some women do not pursue careers in STEM, further adding to the underrepresentation of female lecturers in STEM courses at TVET colleges.

As data for this study were gathered, it became evident that some of the engineering students in the sample encountered gender stereotypes both as a result of their career choice and within the STEM classroom. One participant recounted being chastised for doing what was described to her as a "man's job." Another participant described being mocked in high school for pursuing Technical Drawing, a subject traditionally considered for men. The analysis of the data collected for the study concludes that gender stereotypes have several detrimental effects on women in the workplace: first, women feel judged and are told they cannot pursue a career in science; second, their input and contributions are often overlooked; third, they feel sidelined

and denied opportunities for advancement; and finally, they believe that their family life is jeopardized as a result.

According to Bird (2010), institutional barriers to opportunity and promotion for women faculty members in academia persist, particularly in STEM fields. This issue is reflected in this investigation, where participants argue that the system is failing women because gender norms negatively impact their careers. Bystydzienski and Bird (2006) note that policymakers are beginning to recognize what many women's and gender studies researchers have long argued: the barriers to women's success in academia are systemic. Therefore, instead of expecting women to adapt to the existing structures in science and engineering, these fields must be modified to better embrace and support women. Broad generalizations cannot be drawn from this study due to the small sample size and its focus on a single TVET college in Gauteng. However, this limitation does not preclude "naturalistic" generalization (Guba, 1981), where readers familiar with other contexts may evaluate the transferability (degree of applicability) of some findings to similar situations.

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