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Gender Norms and Female STEM Participation in Mozambique

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Abstract

This study explores the impact of societal views on gender roles and their influence on individual decisions regarding STEM education, with a specific focus on Mozambique. It examines the pervasive gender stereotypes and the roles of family and community in shaping gender norms that affect female participation in STEM fields. Utilizing a qualitative research design grounded in social constructionism, the study engages with female students in Mozambique through in-depth interviews and focus groups to gather insights into the multifaceted gender dynamics in STEM education. The findings reveal significant societal adherence to traditional gender roles, with entrenched stereotypes depicting STEM fields as masculine and unsuitable for women, thus discouraging female participation. Family and community influences play crucial roles, either supporting or hindering women in STEM. Positive social encouragement and gender-based initiatives, however, show potential in altering perceptions and fostering inclusivity. The study underscores the necessity for targeted, culturally sensitive interventions and educational reforms to combat gender disparities in STEM. By highlighting the critical roles of societal views, family, and community, alongside the impact of supportive educational initiatives, this research contributes to strategies aimed at enhancing female participation in STEM, thereby fostering a more equitable and diverse academic and professional environment in these crucial fields.

Keywords: Gender Roles, Mozambique, Social Constructionism, STEM Education.

Introduction

The Mozambican landscapes of STEM (Science, Technology, Engineering, and Mathematics) education reveal ongoing challenges in achieving gender diversity, marked by declining female enrollment and persistent underrepresentation in higher educational and professional spheres. This gap is attributed to societal norms, cultural values, and systemic barriers in education, with Mozambique facing specific challenges such as traditional roles and lower educational achievements for women, further compounded by socio-economic factors that hinder their participation in STEM fields (1,2). Initiatives to improve these disparities include reforms and programs aimed at altering perceptions and encouraging female participation through institutional support and visibility of role models, which are essential for creating conducive environments for female students (3). Additionally, cultural practices like matriliny in northern Mozambique provide a unique context where gender roles can both support and limit educational opportunities, reflecting the complex interplay between traditional values and educational aspirations (4). The economic implications of bridging this gender gap are profound, as greater female participation in STEM could significantly enhance innovation and economic growth by diversifying perspectives and solutions in these crucial fields (5). Exploring societal and cultural influences on gender diversity in STEM globally is crucial, as these factors deeply impact career aspirations and the professional landscape. Cultural norms and gender roles significantly dictate gender roles, with stereotypes associating STEM with masculinity, discouraging women from these fields and reinforcing disparities (6,7). Educational experiences that promote gender-neutral environments can help dismantle these stereotypes (8). Variations across nations also show different extents of disparities, influenced by cultural and economic conditions (9). Societal values that prioritize male dominance in STEM fields affect women's participation rates,

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necessitating policies and programs that address these biases (10). Effective interventions must be culturally sensitive, tailored to specific societal norms to increase female participation in STEM (11). Addressing these societal and cultural factors is essential for fostering a diverse and inclusive STEM environment conducive to all genders. In Mozambique, where the Gender Inequality Index was 0.477 in 2022 and the country ranked 118th on the Human Development Index, significant gender disparities in education persist (12). The Mozambican government has endeavored to address these through strategic initiatives like the Five-Year Plan (2015-2019) and the Strategic Plan for Higher Education (2012-2020), which emphasize inclusive education and gender. Despite these efforts, female participation in higher education STEM fields remains markedly low, with involvement in areas such as Engineering and Sciences ranging just from 1% to 5% (13). Cultural factors including traditional initiation rituals and societal expectations significantly impede girls' educational progression and interest in STEM (14). Interventions including school dialogues and science camps have been implemented to counteract these barriers, yet challenges persist due to enduring stereotypes and the influence of educational systems (15). This indicates a clear research gap, necessitating a comprehensive investigation into how societal views on gender roles, specific stereotypes about gender and STEM education, and the role of family and community shape gender norms affecting participation in STEM, as well as the evaluation of gender-based initiatives supporting women in STEM (16). Thus, this study aims to explore the impact of societal views on gender roles on individual decisions to pursue or avoid STEM careers, identify and analyze the prevalent gender stereotypes, and examine the roles that family as well as community play in shaping gender norms affecting participation in STEM education in Mozambique. This research is significant as it addresses critical issues of gender diversity and inclusion, pivotal for fostering innovation and equitable growth within the global economy and especially in developing countries like Mozambique. By uncovering underlying biases and structural barriers that deter diverse gender participation and by dismantling harmful stereotypes, this study will provide insights crucial for designing educational policies and community programs aimed at increasing gender diversity in STEM fields. This, in turn, can lead to a more inclusive and balanced scientific community capable of producing diverse solutions to complex challenges, thus driving forward both local and global development.

Theoretical Framework

Social Constructionism is a theory that posits realities, knowledge, and social phenomena are constructed through social interactions and shared understandings within specific cultural and historical contexts (17). The theory offers a nuanced perspective on female participation in STEM, highlighting how cultural and societal constructs influence women's engagement in these fields across educational levels. Gender norms, deeply rooted in these cultural constructs, play a significant role in shaping perceptions of suitability and capability in STEM fields, often discouraging women from participation. Cultural stereotypes associating STEM with masculine traits can deter women from these careers, a situation exacerbated by educational practices and media portrayals reinforcing traditional gender roles (18). Interventions that challenge these stereotypes, such as providing female role models and supportive peer networks, are crucial in reshaping perceptions and fostering a more inclusive STEM identity (19). Additionally, leveraging social capital through networking can enhance women's access to resources and support, improving their educational and career outcomes in STEM (20). However, persistent barriers such as bias in classroom interactions and a lack of institutional support highlight the need for comprehensive strategies including policy changes and curriculum reforms to support diversity (21). Addressing these societal and cultural factors is crucial for enhancing gender diversity in STEM, enriching the field with diverse perspectives and fostering innovative solutions.

Conceptual Framework

To conceptualize the relationships between societal views, cultural influences, family/community impacts, and gender diversity for females in STEM, a multi-layered model is proposed. This model underscores how societal norms and cultural contexts, including stereotypes that associate STEM fields with masculine traits, can deter women from these careers, while also affecting the perceived desirability of these

professions (3). Family and community play essential roles, either supporting or discouraging women in STEM through attitudes towards education and gender equality, and through local education programs that shape girls' aspirations and capabilities in STEM (9). Gender diversity initiatives from educational institutions or organizations aim to combat female underrepresentation in STEM through mentorship, scholarships, and workshops, with their effectiveness depending on their ability to address specific cultural and societal barriers (22). As shown in Figure 1, this model suggests that societal views and cultural influences shape the context for family and community impacts, which directly influence women's experiences and decisions regarding STEM education and careers, with gender diversity initiatives intersecting at all levels to enhance support systems and mitigate negative influences. This comprehensive framework highlights the complex interplay of multiple dimensions affecting women's participation in STEM, emphasizing the need for targeted, culturally sensitive interventions.

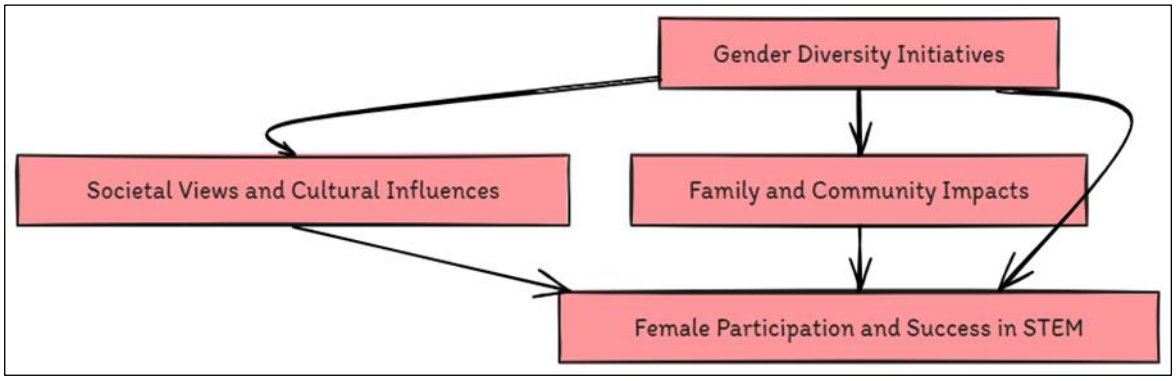

Figure 1. Comprehensive Framework of Societal, Family, and Community Influences on Females' Participation in STEM

Research indicates that gender disparities in STEM education are perpetuated by a confluence of sociocultural, environmental, and institutional barriers that limit female participation both in Mozambique and globally. The literature underscores that cultural stereotypes linking STEM to masculine traits serve as a significant deterrent, perpetuating societal beliefs that these careers are unsuitable for women (23). Specifically, in Mozambique, such disparities are exacerbated by factors including lower female education levels, literacy, and language proficiency, which are further magnified by prevailing traditional roles and norms (24). Scholars argue for the necessity of effective interventions that transcend these barriers, advocating for educational policies that promote early female engagement in STEM and support mechanisms such as role models and mentoring programs (2). Additionally, enhancing girls' self-efficacy in STEM through bespoke educational initiatives has been identified as a potent strategy to elevate their participation and success in various educational milieus (25). Therefore, a comprehensive and multifaceted approach involving societal, educational, and policy amendments is advocated as essential for diminishing these gender disparities and cultivating a more inclusive and equitable educational landscape in STEM fields. Evidence from studies highlight the profound influence of societal norms and cultural expectations on the educational and career trajectories of females, particularly in the realm of STEM education, both globally and in Mozambique. Cultural norms that delineate gender roles have been shown to deter females from STEM fields, attributing such fields as incompatible with feminine identities, thereby creating significant gender gaps (26). In Mozambique, entrenched traditional roles that prioritize domestic responsibilities over academic achievements pose formidable barriers to girls, especially in the male-dominated STEM fields (2). These cultural norms are often mirrored within educational institutions, where the socialization processes may either foster or impede females' sense of belonging in STEM environments (27). Similar challenges are evident in Northern Nigeria, where traditional gender roles, poverty, and gender segregation significantly limit women's access to education, compounded by patriarchal structures and the underrepresentation of women in decision-making positions (28). In Samburu County, Kenya, cultural values and negative

perceptions about women exacerbate gender disparities in education and career aspirations, with socio-economic status, role models, and residential location playing crucial roles in shaping their paths (29). Across Asia, women's career aspirations are influenced by factors such as self-efficacy, social support, and cultural expectations, but barriers like gender stereotypes and social pressure continue to restrict their career development (30). Moreover, pervasive gender norms curtail young women's access to vital STEM education opportunities, significantly influencing their broader life decisions (31). Additionally, prevailing gender stereotypes that label STEM as predominantly male-oriented further discourage female participation, reinforcing the perception that STEM careers are unsuitable for women (6). Similar socio-cultural challenges, including early marriage and gender-based educational expectations, often prioritize immediate economic contributions over educational attainment, hindering girls' enrollment and persistence in education (2). However, targeted educational interventions have demonstrated potential in shifting local perceptions and promoting gender equality, thereby enhancing female participation in STEM (32). These issues are not isolated to Mozambique but are echoed in regions like India, where societal expectations and entrenched gender roles similarly restrict women's opportunities in STEM, suggesting a pervasive global pattern of gendered educational segregation (33). This body of work underscores the need for comprehensive strategies that encompass educational reform, community engagement, and policy modifications aimed at fostering gender equality and empowering women in STEM fields globally. Scholarly works reveal robustly demonstrates that socio-cultural norms, particularly those shaped by family and community, exert a profound influence on women's participation in STEM education. Family dynamics play a critical role, with the educational levels of parents, especially mothers, showing a strong correlation with children's inclination towards STEM fields. Studies indicate that boys, and those whose mothers have attained higher levels of education, are more likely to pursue STEM, highlighting the impact of parental education and expectations on shaping gendered career aspirations (34,35). Additionally, community and cultural norms further entrench stereotypes that characterize STEM as a masculine domain, thus deterring female participation and affecting their sense of belonging in these fields (10,36). The literature also underscores the criticality of educational interventions that aim to modify these perceptions and enhance support systems within educational frameworks, which are pivotal for boosting female representation and retention in STEM (37). Addressing these interrelated factors is essential for advancing gender equity in STEM education and careers, which is fundamental to fostering a more inclusive and diverse academic and professional environment in these critical fields. Previous studies underscore the profound impact of stereotypes on gender participation in STEM education, notably in contexts such as Mozambique where societal norms stereotypically label STEM fields as masculine, thereby significantly deterring female participation (38). In Mozambique, entrenched traditional gender roles that prioritize domestic responsibilities over academic pursuits pose additional barriers, with educational institutions further reinforcing these barriers and affecting females' sense of belonging in STEM fields (2,39). Moreover, while interventions such as mentoring programs with female role models have demonstrated positive effects on young women's attitudes toward STEM, pervasive gender norms continue to restrict the opportunities essential for pursuing education in these fields (40,41). Additionally, stereotypes are found to negatively influence women's self-efficacy in STEM, a consequence of educational practices that often fail to effectively counteract gender biases (7,42). Initiatives like UNESCO's campaigns aim to challenge these stereotypes and promote gender-sensitive teaching practices that empower young women (43). The literature thus suggests that addressing these stereotypes necessitates comprehensive educational reforms and active community engagement to enhance female participation and retention in STEM fields. Thus, this research is guided by inquiries into how do societal norms and perceptions of gender roles influence female participation in STEM education in Mozambique? Specifically, through what mechanisms do prevalent gender stereotypes and family and community expectations shape gender-

related decisions, aspirations, and engagement in STEM fields?

Methodology

Research Design

This study employs a qualitative research design underpinned by a constructivist philosophy, emphasizing that knowledge is constructed through human activity and shaped by social interactions and cultural norms. Adopting this perspective is particularly pertinent for exploring the multifaceted gender dynamics in STEM education in Mozambique, as it allows for the subjective interpretation of social realities, enabling a deeper understanding of how female students across different age groups perceive and are influenced by gender roles within STEM fields. By utilizing open-ended qualitative methods such as in-depth interviews and focus groups, the research aligns with constructivist principles, facilitating rich, dialogic interactions that enable participants to express their experiences and perceptions in their own words. This approach ensures that the findings are deeply grounded in the participants' lived experiences, thus providing a contextualized understanding of the influences of gender norms and societal expectations on their educational choices and opportunities in STEM. The relevance of a constructivist philosophy in this research design is highlighted by its focus on the diversity of human experiences and the co-construction of meaning between researchers and participants, which is crucial for addressing complex social phenomena such as gender dynamics in education (44,45).

Research Instrument

The study is designed to explore various dimensions of gender roles in STEM education in Mozambique through carefully structured questions based on previous studies. It examines the impact of societal views on gender roles on individual decisions in STEM fields by asking, "In your opinion, how does society's view of gender roles affect individuals' decisions to enroll in STEM fields?" supported by Hand, Rice, and Greenlee's findings on the influence of societal biases (46). To identify and analyze prevalent gender stereotypes, the question posed is, "What specific stereotypes about gender and STEM are prevalent, and how do these stereotypes affect the aspirations and behaviors of individuals with different gender identities?" referring to Ertl, Luttenberger, and Paechter's work on stereotypes affecting female students' self-concept (38). The role of family and community is investigated through the question, "In what ways do family and community contribute to shaping the gender norms that impact the participation of various genders in STEM education and careers?" citing Macía, Maharaj, and Gresh's study on masculinity and behavior (47). Finally, to understand the impact of gender initiatives, the question, "What are the gender-based initiatives to encourage or support females in pursuing education in STEM in Mozambique?" is included, drawing on Arndt, Benfica, and Thurlow's research on biofuels and gender (48). These questions collectively aim to provide comprehensive insights into the gender dynamics influencing STEM education in Mozambique.

Rational for Selection of Participants and Sampling

The study aimed at understanding human experiences, attitudes, behaviors, and emotions, essential for investigating gender roles within STEM education in Mozambique (49). Using purposive sampling, the methodology targets 19 female students aged 18 to 20 studying chemistry and physics pedagogy at a Mozambican university, chosen to reflect a group likely influenced by gender norms in STEM. This focus on female participants is justified by the need to explore the unique challenges and experiences faced by women in STEM fields, where gender disparities are significant. Focusing on women can illuminate specific educational and social environment factors affecting their academic and career choices in STEM, supporting the development of targeted interventions to encourage more women in these fields, where they are historically underrepresented (50,51). This approach enriches understanding of gender dynamics in STEM education and contributes to broader educational and policy strategies aimed at fostering greater equity in STEM fields.

Data Collection

The data collection is tailored to capture the nuanced experiences of female students enrolled in chemistry and physics pedagogy at a Mozambican university. This demographic is specifically targeted through purposive sampling to provide rich, context-specific insights due to

their likely exposure to prevailing gender norms in STEM, a focus justified by the need to understand the unique challenges and experiences faced by women in these fields where gender disparities are notable (49). Data are meticulously recorded and transcribed verbatim, ensuring accuracy and authenticity in subsequent analysis. Ethical considerations, including informed consent and maintenance of participant confidentiality, are rigorously adhered to, providing a safe environment for open discourse.

Data Analysis

Data analysis for this study was conducted using thematic analysis, specifically employing Braun and Clarke's six-phase framework to rigorously examine the qualitative data collected from interviews and focus groups (52). The analysis began with transcription of recordings, followed by familiarization with the data, where the team noted initial coding ideas. Systematic initial codes were then generated to identify relevant data features, leading to the collation of these codes into potential themes that encapsulate societal views on gender roles, stereotypes, and the influence of family and community on gender norms in STEM. The themes were meticulously reviewed and refined to ensure they represented the participants' experiences accurately, focusing on how societal views, as reported by (46), stereotypes as discussed by(38), and the roles of family and community as described by (47), and the impact of gender initiatives highlighted by Arndt, Benfica, and Thurlow (48), influenced educational trajectories. In the final phases, these themes were defined, named, and compiled into a comprehensive report, presenting a detailed discussion of the findings in relation to the theoretical framework and research literature. The entire thematic analysis process was facilitated by the use of ATLAS.ti, a powerful software tool that aided in the organization, coding, and retrieval of data, enhancing the efficiency and depth of the analysis (52). This approach not only enriched the understanding of gender dynamics in STEM education in Mozambique but also contributed to broader discussions on gender equality in education.

Rigour and Trustworthiness

To ensure the rigour and trustworthiness of this research on gender dynamics in STEM education in Mozambique, several methodological strategies have been employed to enhance the credibility, transferability, dependability, and confirmability of the findings. Central to these strategies is the use of triangulation, where multiple data sources—including in-depth interviews, focus groups, and review of relevant literature—are analyzed to cross-verify the data collected, facilitating a comprehensive understanding of the studied phenomena and helping confirm the consistency of the information derived from different participants and viewpoints (53). Moreover, maintaining a detailed audit trail of all research phases, from data collection through to analysis using thematic analysis facilitated by ATLAS.ti, ensures transparency and reproducibility (52).

Results

Our thematic analysis reveals several key themes that elucidate society's views on gender roles and their impact on decisions to enroll in STEM fields, specific stereotypes about gender and STEM education, and the contributions of family and community in shaping gender norms. Furthermore, we explore gender-based initiatives designed to support females in pursuing education in STEM. Participants highlighted a strong societal adherence to Traditional Gender Roles and Expectations, noting that from a young age, there are distinct expectations set for boys and girls. Many responses indicated that girls are often expected to prioritize domestic duties over academic pursuits, which may limit their access to education, particularly in STEM fields. Respondents also noted Societal Resistance to Gender Equality in Education, with substantial pushback against gender equality in professional and educational spheres, often discouraging women from entering 'male-dominated' fields such as engineering. The theme of Stereotyping of Professional Capabilities by Gender revealed persistent societal beliefs that certain professions are more suitable for one gender over another, adversely affecting individual aspirations and career choices. Such stereotypes not only pigeonhole professional capabilities but also significantly affect self-perception and self-confidence, as indicated in the Influence of Societal Perceptions on Self-Confidence theme. Several responses highlighted that societal message deeming certain fields as inappropriate for women lead to self-doubt and discourage them from pursuing these field. Conversely, the theme

Positive Social Encouragement and Support showed that when encouragement and support are present, they can effectively counteract negative stereotypes and foster ambitions across various fields, highlighting the potential for societal change. Our findings underscore prevalent stereotypes, such as Gender-Specific Roles, where fields like exact sciences are deemed more suitable for men, while social sciences are seen as more fitting for women. Such stereotypes significantly limit aspirations and can lead to Internalized Incompetence, where individuals feel inherently less capable of succeeding in certain fields due to their gender. However, some individuals are motivated by these stereotypes to overcome them, as shown in the Motivation to Overcome theme. Conversely, Negative Characterizations of women in certain fields can label them as "weak and lazy," further influencing career choices. Family and community play a crucial role in shaping gender norms, as highlighted in our analysis. The Foundational Influence theme describes how initial attitudes toward gender roles are established early in family settings. Support and Encouragement from family and community were emphasized as pivotal in motivating individuals to pursue STEM, despite societal barriers. However, Norm Setting by family and community can either encourage or discourage participation in STEM based on perceived gender roles. Several gender-based initiatives were identified, including Collaborative Programs between organizations aimed at increasing female participation in STEM. The theme of Value and Support highlights efforts to recognize and support women's involvement in STEM, showing a positive societal impact. However, a Lack of Awareness of such initiatives suggests the need for better dissemination and public engagement to ensure these efforts reach their intended audiences. Additionally, Encouragement from Teachers was noted as a significant factor in supporting students of all genders to pursue STEM careers.

Discussion

The thematic insights from a study on societal views on gender roles and the impact on individual decisions regarding STEM education align closely with literature indicating that traditional gender roles and societal resistance significantly influence the educational and career paths of females in STEM (26). These societal norms often limit girls' educational opportunities by emphasizing domestic duties and perpetuating gender stereotypes that deem STEM fields as inappropriate for women, thereby affecting their self-confidence and career choices (27). However, findings also suggest that positive social encouragement and support can counteract these negative stereotypes and foster female ambitions across various fields, highlighting the transformative potential of targeted educational interventions to promote gender equality and enhance female participation in STEM (32). The themes identified in our study, including gender-specific Roles, Internalized Incompetence, and the Motivation to Overcome, align with the literature on the profound impact of stereotypes on gender participation in STEM education, especially in Mozambique. Stereotypes that portray STEM fields as predominantly masculine deter women from these areas (38), contributing to feelings of Internalized Incompetence where individuals believe they are less capable due to their gender, akin to global impacts on women's self-efficacy in STEM (7). Additionally, traditional gender roles in Mozambique emphasize domestic responsibilities over academic pursuits, exacerbating negative characterizations that label women as "weak and lazy," thereby hindering their educational progress (2). However, mentoring programs with female role models and UNESCO's campaigns promoting gender-sensitive teaching have shown positive impacts, helping to counteract these stereotypes and empower women in STEM (41).In Mozambique, the participation of women in STEM education is significantly influenced by socio-cultural norms established within family and community contexts, as underscored by both our study findings and the literature. The foundational influence theme from our analysis aligns with the observation that parental education levels, especially those of mothers, have a substantial impact on children's interest in STEM fields. Studies indicate that children, particularly boys and those whose mothers have attained higher education levels, are more inclined to pursue STEM, highlighting the crucial role of parental support and expectations in shaping gendered career aspirations (35). Additionally, community and cultural norms further reinforce stereotypes that depict STEM as a masculine field, thereby discouraging female participation and affecting

their sense of belonging in these academic areas (10). However, the support and encouragement theme from our findings illustrates the positive impact that supportive family and community environments can have on motivating individuals to pursue STEM, despite these societal barriers. Educational interventions that aim to alter these perceptions and increase support systems within educational settings are crucial for enhancing female representation and retention in STEM (37). Addressing these intertwined factors of family influence and community norms is essential for advancing gender equity in STEM education and careers, fostering a more inclusive and diverse academic and professional environment in these critical fields. The integration of gender-based initiatives with broader societal views on gender roles and the influence of family and community underscores their transformative potential in STEM education. Collaborative programs aimed at increasing female participation in STEM confront societal adherence to traditional gender roles that restrict women's opportunities, especially in male-dominated fields like engineering. These initiatives directly address barriers such as the societal expectation for girls to prioritize domestic duties over academic pursuits and the substantial resistance to gender equality in education. By providing value and support, these programs counteract gender stereotypes that negatively affect women's self-perception and confidence, challenging societal messages that deem certain fields inappropriate for women and reducing feelings of internalized incompetence. Moreover, the lack of awareness about these initiatives highlights the need for improved dissemination and public engagement, crucial for changing societal norms and complementing the pivotal role of family and community. These findings emphasize how family and community can establish initial gender roles and how support from these spheres, alongside encouragement from teachers, motivates individuals to pursue STEM despite societal barriers. Thus, these gender-based initiatives not only address direct barriers but also support broader movements towards gender equality in education and professional spheres, enhancing visibility, strengthening community and educational support systems, and fostering a more inclusive and diverse academic and professional environment.

In Mozambique, significant gender disparities in education are underscored by its position on the Gender Inequality Index and the Human Development Index, where traditional gender roles and cultural factors such as initiation rituals impede girls' educational progression and interest in STEM, aligning with the societal adherence to gender norms highlighted in our study (12,14). The persistence of stereotypes, as discussed in themes like Stereotyping of Professional Capabilities by Gender and Influence of Societal Perceptions on Self-Confidence, resonates with the broader challenges faced by Mozambican girls, contributing to low female participation in STEM fields, reported between 1% and 5% despite strategic initiatives aimed at promoting gender equity (13). However, interventions such as school dialogues and science camps that challenge stereotypes and foster supportive environments are aligned with the study's findings on the positive impact of social encouragement and the pivotal role of family and community, demonstrating potential avenues for mitigating these barriers (15). Enhancing the visibility and dissemination of gender-based initiatives, alongside strategic educational policies and community engagement, could significantly advance efforts to bridge the gender gap in STEM education in Mozambique, suggesting a critical need for ongoing research and evaluation of these interventions to adapt them effectively to the evolving educational landscape. The theoretical and conceptual frameworks established in our study, particularly social constructionism, align closely with empirical findings on the impact of societal views, family influence, and gender-based initiatives on female participation in STEM fields. Social constructionism posits that societal constructs and cultural contexts significantly influence such participation, both enabling and restricting it (17). Our findings corroborate this, highlighting societal adherence to traditional gender roles that discourage women from entering male-dominated fields like engineering and perpetuate stereotypes that certain professions are unsuitable for specific genders, leading to phenomena such as internalized incompetence (18). The conceptual framework further underscores the critical roles family and community play in shaping these gender norms, which our empirical evidence supports by

demonstrating both supportive and restrictive influences from these spheres on individuals' STEM-related decisions (9). Additionally, gender-based initiatives aimed at combating female underrepresentation in STEM highlight the intersection of societal, family, and educational influences, though a noted lack of awareness about these initiatives suggests gaps in their reach and implementation, emphasizing the need for comprehensive strategies that include policy changes and curriculum reforms (22). Thus, our study substantiates the need for targeted, culturally sensitive interventions that can reshape societal perceptions and improve educational and career outcomes for women in STEM, enriching the field with diverse perspectives and fostering innovative solutions. To effectively enhance female enrollment in STEM fields in Mozambique, a multifaceted strategy is required that addresses both societal and educational barriers while aligning with ongoing national educational strategies. Female students should actively seek out mentorship from female STEM professionals and participate in STEM-focused activities such as workshops and clubs to build skills and resilience against societal stereotypes (54). Teachers need to foster inclusive classroom environments that highlight the achievements of women in STEM, encourage female students to lead projects, and challenge gender stereotypes through diverse curricular content (55). Policymakers should strengthen support for gender-focused programs by increasing funding, implement public awareness campaigns promoting gender equality, and continually assess the effectiveness of these initiatives (43). Engaging family and community in dialogue and education about the benefits of STEM careers for women can further reinforce these efforts. By integrating these strategies with Mozambique's Strategic Plan for Higher Education, such measures can help reduce gender disparities and promote significant contributions from women in science and technology, thereby transforming societal norms and fostering a dynamic and inclusive academic environment in STEM fields (56).

Conclusion

This research has provided valuable insights into the societal, cultural, and familial factors influencing gender diversity in STEM education in Mozambique, demonstrating the profound impact of traditional gender roles, societal stereotypes, and community norms on the participation of women in STEM fields. Our findings reveal that entrenched societal beliefs about gender roles and professional capabilities continue to pose significant barriers to women's entry and success in STEM. While initiatives such as mentoring programs and educational reforms have made strides toward inclusivity, the persistence of gender disparities highlights the need for a sustained and strategic approach to foster gender equality in STEM education. This study faces several limitations that must be acknowledged. First, the qualitative nature of the research, while providing depth of understanding, limits the generalizability of the findings. The study's focus on a specific age group and geographical area within Mozambique may not capture the full spectrum of experiences and perceptions of all women across different regions and educational backgrounds. Additionally, the reliance on self-reported data could introduce bias in the responses, as participants might provide socially desirable answers or may not fully recall all relevant experiences. Furthermore, the sample lacks sufficient diversity, which may limit the generalizability of the findings to the broader population of Mozambique. The qualitative nature of the research, while offering rich insights, also restricts the extent to which the results can be applied to other contexts or populations. Future research should aim to expand the demographic and geographic scope of the study, incorporating a more diverse participant pool to enhance the representativeness and applicability of the findings. Quantitative methods could also be employed alongside qualitative approaches to provide a broader, statistically generalizable understanding of the factors influencing gender diversity in STEM. Longitudinal studies would be beneficial to track changes over time and assess the long-term impact of current educational reforms and initiatives. Moreover, future studies should explore the effectiveness of specific interventions in greater detail, such as the role of digital and media literacy in combating stereotypes and promoting gender equality in STEM education. To further address the challenges identified in this study, it is also crucial to investigate the intersectionality of gender with other factors such as socioeconomic status,

ethnicity, and disability, to fully understand the barriers faced by diverse groups of women in STEM fields. Exploring these dimensions will help tailor interventions more effectively to the needs of all participants and contribute to the creation of a truly inclusive educational environment.

Abbreviation

Nil.

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Author Contributions

All authors have equally contributed.

Conflict of Interest

Author declared there is no conflict of interest.

Ethics Approval

Not applicable.

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