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The Impact of Gender Stereotype on Female Participation in Stem (TVET) Fields in Nigeria

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Abstract: *The research examines the impact of gender stereotypes on female participation in Science, Technology, Engineering and Mathematics (STEM) fields in Nigeria. The objective of the research is to understand the barriers that prevent female gender in participating in STEM fields and to identify ways to address these barriers. The target population was all female students and female lecturers in School of Applied Sciences and School of Engineering STEM (TVET) programs at the Polytechnic. The sampling method was simple random sampling using Wolter's formula for sample size of Two Hundred and Eighty-Six (286). The survey was administered online using Google Forms, and participants were recruited through the WhatsApp groups. The data was analyzed using SPSS. The statistical analysis revealed that gender stereotypes (EPL, MP, and CB) are significant predictors of STEM participation. Specifically, a one-unit increase in any dimension of gender stereotype (Equal Pay laws, Mentorship program, and Cultural barriers) leads to a 0.058, 0.477, and 0.397 increase in STEM participation, respectively. These findings suggest that gender stereotypes are a substantial barrier to female participation in STEM fields, and are reinforced by education, media, and societal norms. Hence, the study recommends improved education and awareness about the problem of gender stereotypes, Support for females in STEM fields, including mentorship and networking opportunities and policy changes to address gender inequality in STEM fields.*

Keywords: Gender, stereotype, education, STEM (TVET)

Introduction

Gender stereotypes have been shown to play a significant role in the career aspirations of both men and women. However, this effect is particularly pronounced in STEM (TVET) fields, which have historically been dominated by men. In developing countries, such as Nigeria, the effects of gender stereotypes are amplified by cultural and societal expectations for women. In Nigeria, women face a number of barriers to pursuing STEM (TVET) careers, including limited access to education, limited career options, and negative attitudes towards women in these fields. These barriers can have serious consequences for the participation of women in STEM. In addition to these barriers, women in Nigeria also face challenges in terms of balancing their personal and professional lives. The expectation that women will prioritize family and domestic responsibilities over their career can further limit their ability to pursue STEM (TVET) careers. Furthermore, cultural beliefs about the appropriate roles for men and women can lead to discrimination against women in STEM (TVET) fields (KHOMOTSO , 2016). This discrimination can manifest in a variety of ways, including unequal pay, unequal treatment in the workplace, and a lack of recognition for women's contributions to the field.

It is important to note that these barriers are not only experienced by women, but also by girls and young women who are considering pursuing a career in STEM (TVET). This can have a significant impact on the number of women who ultimately choose to pursue STEM (TVET) careers. In order to address these challenges, it is important to take a holistic approach that addresses both the systemic and cultural barriers to women's participation in STEM (TVET) fields. This could include policies that promote equal pay and treatment in the workplace, as well as educational programs that encourage girls and young women to consider STEM (TVET). There are also some other initiatives that could be implemented, such as the promotion of role models in STEM (TVET) fields. Promoting women who have been successful in these fields can help to inspire the next generation of women to pursue careers in these areas. Additionally, the promotion of positive media representation of women in STEM (TVET) fields can help to change the public perception of these fields as being male-dominated (Grace, 2023).

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Despite the importance of STEM (TVET) fields, women are still underrepresented in these fields, due to a variety of systemic and cultural barriers. This has a negative impact on the future of STEM (TVET) fields, as well as on women's participation in the workforce (Margaret Ngugi & Purity , 2017). And it is against this background that this research topic looked at the effect of gender stereotypes of female students in STEM (TVET) and the specific objectives are:

(i) To determine the impact of equal pay laws and policies on female gender in STEM (TVET)
(ii) To assess the effectiveness of mentorship programs for female students in STEM (TVET)
(iii) To examine the effect of cultural barriers on female students' interest in STEM (TVET).

Literature Review

Conceptual Review

Gender stereotypes are oversimplified ideas about what behaviors and attitudes are appropriate for men and women. They can be both positive and negative, and they can lead to inaccurate and harmful assumptions about people. In the context of STEM fields, gender stereotypes often lead to a belief that women are not as capable or interested in STEM as men. STEM stands for science, technology, engineering, and mathematics (Blackstone, 2023). It refers to a broad range of academic disciplines that involve research and problem-solving. STEM fields often require a strong background in mathematics and science, and they can lead to careers in a variety of industries (Blotnicky, Franz-Odendaal, & French, 2018). Research has shown that female students often face a number of challenges in STEM fields, including stereotypes about their abilities and interests, a lack of role models and mentors, and a hostile or unsupportive environment (Elena, Belinda, & Walter, 2019).

Theoretical Review

There are a few different theories that could be relevant to this research. One is social cognitive theory, which suggests that people's behavior is influenced by their observation of others' behavior and the environment around them (Jeremy, 2021). This theory could help to explain how the stereotypes and lack of role models can impact female students in STEM fields. Social cognitive theory suggests that female students might need to see more successful female role models in STEM fields, in order to believe that they can also be successful. This suggests that interventions to promote female role models in STEM could be effective (Mcleod, 2024). One limitation of social cognitive theory is that it doesn't consider the influence of other factors, such as personality traits or individual differences. to operationalize these theories (Govindaraju, 2021). This means translating the theories into concrete variables that we can measure and analyze in the research. In this case, Social cognitive theory can be operationalized by measuring variables such as exposure to role models and self-efficacy beliefs (MG, 2020).

Another theory is expectancy-value theory, which suggests that people are more likely to engage in an activity if they expect to be successful and value the outcome (Qi & Mengchen, 2024). This theory could help to explain how female students might be more likely to pursue STEM fields if they feel like they can succeed and value the career opportunities that STEM fields offer (Dökme *et al.,* 2022). This theory suggests that female students might need to understand the benefits of pursuing a career in STEM, such as job satisfaction, salary potential, and opportunities for advancement (Chen, So , & Zhu, 2024). This suggests that interventions should focus on helping female students understand the value of STEM careers. The limitation of expectancy-value theory is that it doesn't take into account factors such as the support of family and friends (Team, 2023)

In addition to these theories, we could also consider theories such as the social identity theory and the gender-role socialization theory. The social identity theory suggests that people's sense of self is strongly influenced by their social group membership, and this theory could help to explain the importance of role models for female students in STEM fields. The gender-role socialization theory suggests that people are socialized into gender roles from a young age, and this theory could help to explain the gender stereotypes that persist in STEM fields (Team, 2023: Qi & Mengchen, 2024).

Empirical Review

One study found that female students in STEM fields often experience "imposter syndrome," which is the feeling that they don't belong or are not qualified to be in the field (Gita, et.al, 2023). This study on imposter syndrome found that female students were more likely to attribute their success to external factors, like luck, rather than to their own abilities (Pákozdy, Askew, Dyer, & et al. , 2024). This can lead to a lack of confidence and a fear of failure. Another study found that gender stereotypes can lead to lower self-confidence and lower achievement among female students (Shill-Russell , Russell , Daines, & Clement , 2022) . It's definitely an important finding, and it has implications for how we can help female students in STEM fields. Based on these findings, we could develop interventions that help female students recognize their own abilities and successes, also provide more support and encouragement from mentors and peers.

The lack of role models and mentors for female students in STEM. Research has shown that female students often report feeling isolated in STEM fields, and they can have difficulty finding mentors who share their experiences and perspectives (Mariluz G. , Andoni, Pablo, & Ander, 2022). The lack of role models and mentors can have a major impact on female students' success in STEM fields (Mariluz G. , Andoni, Pablo, & Ander, 2022). To address this issue, we could create programs that connect female students with mentors who are already working in STEM fields. These mentors could provide support, guidance, and a sense of community for the students.

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Materials and Methods

The research design was a quantitative approach that used a descriptive survey to collect data from a sample of female students in STEM (TVET) programs in The Federal Polytechnic, Ilaro, Ogun State, Nigeria. The sampling method was purposive sampling, and the survey instrument was a self-report questionnaire. The simple random sampling method was used and sample size of Two Hundred and Eighty-Six (286) In this case, the sample was selected based on the criteria of gender, and level of education. This method was chosen because it was the most efficient way to reach the target population. The survey was administered online using Google Forms, and participants were recruited through the Polytechnic, WhatsApp groups. The data was analyzed using SPSS, linear regression method.

Presentation and Interpretation of Results

Table 1: Reliability Statistics

Cronbach's Alpha	No of Items
.876	20

Source: Researchers' Computation from SPSS (2024)

Table 1 reveals a coefficient alpha value of .876 (α = .876) against the benchmark of .70. This implies that the tool used for measurement in this study is reliable and can consistently produce a similar result in similar circumstances at all times.

Table 2: Total Variance Explained

Component	Total	% of Variance	Cumulative %	Total	%of Variance	Cumulative %
1	7.721	38.603	38.603	7.721	38.603	38.603
2	1.861	9.303	47.906	1.861	9.303	47.906
4	1.166	5.832	60.273	1.307	6.536	54.441
4	1.166	5.832	60.273	1.166	5.832	60.273
5	1.091	5.457	65.730	1.091	5.457	65.730
6	1.007	5.036	70.766	1.007	5.036	70.766
7	.948	4.742	75.508			

Extraction Method: Principal Component Analysis.
Source: Researchers' Computation from SPSS (2024)

Table 2 shows a total variance explained of 75.8% against the bench mark of 50%. This implies that the study is valid and capable of measuring what it intends to measure.

Table 3: Descriptive Statistic

	Mean	Std Deviation	N
STEM	9.3846	3.67242	286
EPL	11.6119	1.90283	286
MP	8.8007	3.74711	286
CB	8.5490	3.62971	286

Source: Researchers' Computation from SPSS (2024)

The above Table 3 shows the Mean and Standard deviation values of the variables used. The mean values for EPL, MP, and CB were 11.6119, 8.8007 and 8.5490 and the Standard deviation values were 1.90283, 3.74711 and 3.62971 respectively. The total number examined was 286.

Table 4: Correlation

		STEM	EPL	MP	CB
Pearson Correlation	STEM	1.000	.162	.773	.744
	EPL	.162	1.000	.190	.101
	MP	.773	.190	1.000	.716
	CB	.744	.101	.716	1.000
Sig. (1-tailed)	STEM	.	.003	.000	.000
	EPL	.003	.	.001	.044
	MP	.000	.001	.	.000
	CB	.000	.044	.000	.
N	STEM	286	286	286	286
	EPL	286	286	286	286
	MP	286	286	286	286
	CB	286	286	286	286

Source: Researchers' Computation from SPSS (2024)

Table 4 indicates that EPL, MP and CB correlate with STEM at (.162, .773, .744) respectively.

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Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R square Change	F Change
1	.820[a]	.673	.669	2.11164	.673	193.335

a. Predictors: (Constant), CB, EPL, MP
b. Dependent Variable: STEM
Source: Researchers' Computation from SPSS (2024)

Table 5 shows R-Square value of .673 (r^2 = .673). This implies that 67% of total variation in STEM is been explained by Gender Stereotype.

Table 6: ANOVA

Model		Sum of Squares	Df	Mean Squares	F	Sig.
1	Regression	2586.249	3	862.083	193.335	.000[b]
	Residual	1257.443	282	4.459		
	Total	3843.692	285			

a. Dependent Variable: STEM
b. Predictors: (Constant), CB, EPL, MP
Source: Researchers' Computation from SPSS (2024)

The f- statistics in the Table 6 (f =193.335); P< 0.05). The above table reveals that P-value is less than 5%. This implies that the null hypothesis will be rejected at 5% significant level and the alternate hypothesis will be accepted at 95% confidence interval.

Table 7: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficient		
		B	Std. Error	Beta	T	Sig
1	(Constant)	1.124	.804		1.398	.163
	EPL	.058	.067	.030	.863	.389
	MP	.477	.049	.487	9.827	.000
	CB	.397	.049	.392	8.017	.000

a. Dependent Variable: STEM

Source: Researchers' Computation from SPSS (2024)

The statistic value in Table 7 reveals that Gender Stereotype (EPL, MP and CB) are potent factors in STEM prediction. It also indicates that a unit increase in any dimension of Gender stereotype (EPL, MP, and CB) results in .058, .477 and .397 increase in STEM.

Discussion of Results

The findings of this study are encouraging, as they reveal a positive and significant impact of equal pay laws, mentorship programs, and addressing cultural barriers on female participation in STEM fields in Nigeria. Firstly, the results show that equal pay laws have a significant impact on promoting gender equality in STEM fields. This suggests that policies aimed at ensuring fair compensation for women in STEM can help reduce the gender gap and encourage more women to pursue STEM education and careers. Secondly, the mentorship program was found to have a positive impact on female participation in STEM. This highlights the importance of providing support and guidance to women in STEM, helping them navigate potential obstacles and stay motivated in their pursuits.

Lastly, addressing cultural barriers was also found to have a significant impact on promoting gender equality in STEM. This underscores the need to challenge and dismantle harmful gender stereotypes and biases that may discourage women from pursuing STEM fields. Overall, these findings suggested that a multi-faceted approach addressing equal pay, mentorship, and cultural barriers can effectively promote gender equality in STEM fields in Nigeria. The results have important implications for policymakers, educators, and organizations seeking to promote diversity and inclusion in STEM. elaborate discussion of the results.

Conclusion and Future Works

The findings of the research support the view that equal pay laws and policies are effective way to improve gender equality in STEM fields and to improve the impact of equal pay laws and policies, the study recommend that the government should conduct regular audits and practices in STEM fields and provide financial incentives to companies that demonstrate gender pay equality

The findings of this research also suggest that mentorship programs can be effective in encouraging female students to pursue STEM fields, but further research is needed to assess the long-term impact of these programs. Therefore, the study recommended that schools should implement mentorship programs specifically for female students in STEM fields.

Moreso, schools and communities should create a culture that encourages and supports girls and women to pursue STEM field such as changing the way STEM subjects are

taught, providing role models and support networks, and promoting positive attitudes towards women in STEM.

References

Blackstone, A. (2023). Gender Roles and Society. Human Ecology: An Encyclopedia of Children, Families, Communities, and Environments, 335-338.

Blotnicky, K. A., Franz-Odendaal, T., & French, F. (2018). A study of the correlation between STEM career knowledge, mathematics self-efficacy, and career activities on the likelihood of pursuing a STEM career among middle school students. *International Journal of STEM education*, 5-22.

Chen, Y., So , W. W., & Zhu, J. (2024). STEM learning opportunities and career aspirations: the interactive effect of students' self-concept and perceptions of STEM professionals. *International Journal STEM* Ed 11.

Dökme, I., Açıksöz, A., & Koyunlu Ünlü , Z. (2022). Investigation of STEM fields motivation among female students in science education colleges. *International Journal STEM* Ed 9, 8.

Elena, M., Belinda, A., & Walter, H. (2019). The Gender Gap in STEM Fields: The Impact of the Gender Stereotype of Math and Science on Secondary Students' Career Aspirations. ORIGINAL RESEARCH article.

Gita, T., Ashana, V., Jitendra, S. K., & Sweta, S. (2023). An Evaluation of Impostor Phenomenon in Data Science Students. *International Journal Environ Res Public Health*.

Govindaraju, V. (2021). A Review of Social Cognitive Theory from The Perspective of Interpersonal Communication. Multicultural Education, 7, 12
.

Grace. (2023). 5 Ways to Encourage Girls into STEM Fields. Nigeria: *WAAW foundation*.

Jeremy, S. (2021). What Is Bandura's Social Learning Theory? 3 Examples. *Positive psychology. International Journal.*

Khomotso, L. M. (2016). *Balancing Work and Family Responsibilities*. Johannesburg: Witwatersrand.

Margaret Ngugi, N., & Purity, M. (2017). Female Participation in Technical, Vocational Education and raining Institutions (TVET) Subsector: The Kenyan Experience. *Public Policy and Administration Research www.iiste.org*, 9-23.

Mariluz, G., Andoni, E., Pablo, G., & Ander, M. (2022). The Impact of Female Role Models Leading a Group Mentoring Program to Promote STEM Vocations among Young Girls. *Sustainability Journal*.

Mariluz, G., Andoni, E., Pablo, G., & Ander, M. (2022). he Impact of Female Role Models Leading a Group Mentoring Program to Promote STEM Vocations among Young Girls. ResearchGate CC.

Mcleod, S. (2024). Albert Bandura's Social Learning Theory. *Simply psychology*.

MG, R. (2020). Personality and interests for selection. *Theoretical perspectives*. Mil Psychol, 7-23.

Pákozdy, C., Askew, J., Dyer, J., (2024). The imposter phenomenon and its relationship with self-efficacy, *Perfectionism and happiness in university students.* Curr Psychol 43, 5153-5162.

Qi, W., & Mengchen, X. (2024). The implications of expectancy-value theory of motivation in language education. *School of International Education*, Shandong University, Jinan, China.

Shill-Russell , C., Russell , R., Daines, B., & Clement , G. (2022). Imposter Syndrome Relation to Gender Across Osteopathic Medical Schools. Med Sci Educ., 157-163.

Team, I. E. (2023). An Introduction to STEM Fields and Careers. An Introduction to STEM Fields and Careers.