



## Transforming Education: Inclusive Strategies for Encouraging Girls' Child in STEM Education in Nigeria

**Gbigbadua, A. Dare**

Department of Arts and Science Education, Kwara State University, Malete.

**Email:** [abdulraheem.gbigbadua@kwasu.edu.ng](mailto:abdulraheem.gbigbadua@kwasu.edu.ng)

### Abstract

Promoting gender equality in Science, Technology, Engineering, and Mathematics (STEM) fields remains a global challenge, particularly in developing countries like Nigeria. The underrepresentation of girls in STEM is a complex issue influenced by socio-cultural norms, inadequate resources, and limited access to quality education. This study explored effective approaches to mitigate these barriers and create an environment where girls feel empowered to pursue STEM careers. The paper adopted a quantitative approach in which data were gathered through the use of questionnaire. A survey was conducted among 100 girls' students in both Junior and Senior Secondary Schools randomly selected across Ilorin West local government of Kwara State. The data analysed revealed that the development of curriculum with real life learning content that relates STEM subjects to real-world applications remains a crucial inclusive strategy. This study concludes that effecting a transformation in education to foster girls' interest in STEM in Nigeria demands the need for real life learning rather than mere classroom engagement.

**Keywords:** STEM, Gender equality, Inclusivity, Inclusive strategies, Girl-Child Underrepresentation in STEM

### Introduction

Gender-equality is derived from two words gender and equality. Gender refers to the socially constructed characteristics attributed to women, men, girls, and boys. These encompass not only norms, behaviours, and roles associated with each gender but also the relational dynamics between them. This construct is not fixed and can vary across societies and evolve over time (World Health Organization, 2023). Gender operates within a hierarchical framework, leading to disparities and imbalances that intersect with other societal and economic inequities. Discrimination based on gender interacts with various other forms of discrimination, including factors like ethnicity, socioeconomic status, disability, age, geographic location, gender identity, and sexual orientation. This stands in contrast to the concept of sex, which pertains to the biological and physiological distinctions between females, males, and intersex individuals (World Health Organization, 2023). In this study, gender is used to mean a psychological, physiological and socially constructed difference that occur between male and female.

Equality on the other hands refers to the need to ensure that every individual has an equal opportunity to make the most of their lives and talents (Equality and Human Right Commission,

2023). Put succinctly, it is the recognition that every human being has the same value. That is, we all have the same rights, we should all receive the same level of respect, and have the same access to opportunities (Australian Human Right Commission, 2023).

Hence, gender equality is conceived as a situation in which individuals irrespective of their genders possess identical rights, obligations, and avenues to actualize their complete capabilities, human rights, and self-respect. This equality extends to participating in and reaping the advantages of economic, social, cultural, and political advancement, thus fostering an environment of inclusivity and shared growth (UNICEF, 2017; Victorian Government, 2023).

Gender equality remains one of the cardinal focus of the Sustainable Development Goals (SDGs). It is aimed at achieving gender equality and empowerment women and girls. This is envisioned to end all forms of discrimination and gaps that exist in political, economic and social ramifications.

The notion of gender equality depicts that there is a gender imbalance in STEM education. Gender imbalance or gender gap denotes a degree of imbalance between male and female in access



and participation in sciences and technology courses or the differences between gross enrolment of male and gross enrolment of female in science and technology courses (UNESCO 2014 cited in (Abdullahi, Abubakar, Abubakar & Aliyu, 2019). The gender gap still exists given the societal stereotype and cultural bias. There is need for an urgent and concerted effort for inclusive strategies in STEM education

Inclusive strategies refer to deliberate approaches, actions, or plans implemented to ensure the involvement, participation, and representation of diverse individuals and groups in various aspects of society, such as education, business, politics, and community development (Agommuoh & Ndirika, 2020). The goal of inclusive strategies is to create an environment where people from different backgrounds, abilities, identities, and perspectives feel valued, respected, and empowered. There are various inclusive strategies to be adopted such as early integration of STEM education at the primary school level, authentic curriculum that is gender-sensitive, gender-sensitive, student-centered and inquiry-based curricular methods, real life learning adventures the girl child could relate with, to mention a few.

The initial concept of STEM, originally known as SMET (Science, Mathematics, Engineering & Technology), was introduced in 2001 at the United States' National Science Foundation by Dr. Judith Ramaley. Dr. Ramaley reconfigured the acronym to STEM, thereby highlighting the integration of Technology and Engineering with Science and Mathematics (Keane, Linden, and Snead, 2022). Broadly speaking, STEM has been defined by the Australian Education Council (2015) as an umbrella term encompassing the teaching of its constituent disciplines: science, technology, engineering, and mathematics. Additionally, it signifies an interdisciplinary pedagogical approach designed to heighten student interest in STEM-related domains while enhancing their problem-solving and critical analysis skills.

In Nigeria, science and technology education plays a pivotal role in the nation's advancement and forward momentum. Recognized as a fundamental catalyst for economic growth, innovation, and global competitiveness, the Nigerian government has demonstrated a resolute

commitment to enhancing science and technology education through various policy endeavors and investments in infrastructure. The National Policy on Education (2004) underscores the significance of science and technology education in national development and advocates for their inclusion into the school curriculum.

Within Nigerian secondary schools, the science curriculum encompasses a range of subjects, including biology, chemistry, physics, general mathematics, further mathematics, and agriculture, physical education, and health education. Concurrently, technology-focused courses encompass technical drawing, general metalwork, basic electricity, electronics, auto mechanics, building construction, woodworking, home management, food and nutrition, as well as clothing and textile studies (Abdullahi, Abubakar, Abubakar & Aliyu, 2019).

Promotion of gender equality across Science, Technology, Engineering, and Mathematics (STEM) fields remains a global challenge. A higher number of girls are currently attending schools than at any previous point in history. Records show that primary, and secondary school enrollment rates are getting closer to equal for girls and boys (90% male, 89% female) (World Bank, 2022; Right to Education, 2023). However, they do not have equal opportunities as boys do such as academic prerogative, access to higher education, feeling of being safe in the classroom, exception from early child marriage (UNESCO, 2023, UNICEF, 2023, Ullah and Ullah, 2019), among others. This constitutes a huge challenge to their ability to fully engage in and derive benefits from the education they desire.

Women participation in STEM-related disciplines remains 28% of the global workforce (STEM Women, 2022). In the context of higher education in the UK, female enrollment in STEM courses stands at a modest 35%. A closer examination of subject distribution reveals that female representation in Engineering & Technology (19%), Computer Sciences (19%), Mathematical Sciences (37%), and Physical Sciences (39%) (FutureLearn, 2023). The trajectory from 2015 to 2019 shows that the number of women graduating in STEM disciplines grew from 22,020 to 24,705. Nevertheless, due to the large number of male graduates, the overall percentage has experienced a slight increment, advancing from



25% to 26% (FutureLearn, 2023). In all of these, it is either they are being excluded or they exclude themselves from participating in STEM related activities. This is a pointer to the need for the global community to do more in encouraging inclusive approach towards Girls' interest in STEM disciplines.

Too many girls and women are held back by biases, social norms and expectations influencing the quality of the education they receive and the subjects they study (UNESCO, 2023). They are particularly underrepresented in STEM education, and consequently, in STEM careers. This gender disparity is alarming, especially as STEM careers are often referred to as the jobs of the future, driving innovation, social wellbeing, inclusive growth and sustainable development.

The United Nations Sustainable Development Goals (UN-SDGs) are determined in their efforts towards bridging the existing gaps in gender disparity. Goal 5 of UN-SDGs specifically focuses on advancing gender equality and the empowerment of women given that the lack of representation spans across all levels (World Economic Forum, 2023) including education, career, leadership, and politics, among others. For Sessou, (2023), gender bias and stereotypes in the workplace can limit career advancement opportunities, insufficient funding for women-led research projects and limited representation of women in leadership roles in the scientific community. Given the above, efforts have been made globally to address the menace of gender disparity. This is done through the adoption of several significant agreements, including but not limited to the 1979's Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) and the Beijing Declaration and Platform for Action of 1995.

For this study, the Theory of Intersectionality was adopted, which was first espoused in the work of the American civil rights advocate and leading scholar of critical race theory, Kimberlé Williams Crenshaw in 1989. The theory recognizes that individuals hold multiple social identities (such as gender, race, ethnicity, socioeconomic status, etc.) that intersect to shape their experiences and opportunities. In Nigeria, there are factors that impede gender equality in STEM education. These factors include among others, uneven access to education, lack of employment equality, job

segregation, lack of bodily autonomy, lack of religious freedom, lack of political representation and societal mindsets (Human Rights Careers, 2023). Inclusive strategies must therefore consider and address the unique challenges which are faced by girls who belong to various intersectional groups, ensuring that the strategies to be employed are tailored to ensuring their inclusivity in STEM education.

Despite the global efforts to enhance gender equality in STEM related fields, gender gaps in STEM related disciplines still remain considerably wide, especially in Nigeria. For instance, the Women Engineers Association of Nigeria (APWEN) has expressed concern about the proportion of women and girls participating in science-related fields and careers. They emphasize that Nigeria has not yet attained gender parity in Science, Technology, Engineering, and Mathematics (STEM) disciplines (Sessou, 2023). According to UNESCO statistics, a mere 3% of researchers in Nigeria are women (Sessou, 2023). This aligns with data from the National Bureau of Statistics, which indicates that women constitute only 22% of the annual graduates in engineering and technology from universities. Sessou (2023) asserts that this gender disparity in science and engineering within Nigeria has exacerbated the shortage of competent professionals in these crucial domains. The above implies more efforts need to be made to bridge the gender gap in involving women in STEM related activities, particularly in developing countries. Specifically, efforts need to be made towards engendering inclusive strategies for encouraging girls' interest in STEM fields in Nigeria. Hence, the need for this study.

### **Purpose of the Study**

The purpose of this study is to investigate the inclusive strategies employed to foster girls' interest in STEM disciplines in Nigerian.

### **Research Questions**

The paper seeks to answer the following questions:

1. What are the inclusive strategies aimed at fostering girls' interest in STEM disciplines within the Nigerian educational context
2. What are the factors influencing the underrepresentation of girls in STEM disciplines in Nigeria



## Methods

This study adopts a quantitative approach in which the inclusive strategies employed to foster girls' interest in STEM disciplines in Nigerian are investigated. Empirical data are collected through the use of questionnaires administered among the school girls in Kwara West Local Government. The population for this study consists of all the girl-children in the 98 secondary schools in Ilorin West

Local Government. There are 4 zones in the local government out of which 5 secondary schools were selected in each zone. 100 students (20 in each) of the public secondary schools in Ilorin West Local Government were selected to respond to the questionnaire through simple random sampling method. The sample size was determined using Serdar, Cihan Yucel and Sedar (2021) estimation table (See Table 1):

**Table 1**

*Sample size estimation according to the population size (merely as rough estimates), margin of error (ME) and confidence interval (CI)*

Population Size	Margin of error (ME) (for CI 95%)			Confidence Interval (CI) (for ME 5%)		
	10%	5%	1%	90%	95%	99%
100	50	80	99	74	80	88
500	81	218	476	176	218	286
1000	88	278	906	215	278	400
10,000	96	370	4900	264	370	623
100,000	96	383	8763	270	383	660
1,000,000	97	384	9513	271	384	664

**Source:** <https://stats.stackexchange.com>

The questionnaires were administered among the JSS 1 and SS1 students in the selected secondary schools. Out of 100 questionnaires that were administered, only 97 were returned.

The questionnaire to investigate the inclusive strategies employed to foster girls' interest in STEM disciplines in Nigerian was designed. The questionnaire has 3 sections. The section 1 contains the demographic information of the respondents. Section 2 contains the list of the Inclusive strategies aimed at fostering girls' interest in STEM disciplines while section 3 contains items on the Barriers to Gender Equality in STEM Fields.

The validity of the research instrument was ascertained by the experts and colleagues in the field of education. While the reliability of the

research instrument was conducted using test-retest approach. The pilot test was conducted among 10 girl-students in the selected secondary schools within the local government. The administration of the questionnaire was done after 2 weeks on the same set of the respondents. Data collected were analyzed using Pearson Product Moment Reliability Formula. The correlation coefficient of 0.79 was obtained showing the reliability of the research instrument.

The data collected was analysed using descriptive statistics namely simple percentage to find out the Inclusive strategies aimed at fostering girls' interest in STEM disciplines and barriers to Gender Equality in STEM Fields. The questionnaires were analysed using SPSS version 14.

## Discussion and Findings

**Table 2**

<i>Inclusive strategies aimed at fostering girls' interest in STEM disciplines</i>	
Inclusive Strategies Percentage	Frequencies
Early integration of STEM education at the primary school level 19.6	19
Authentic curriculum that is gender-sensitive 12.4	12



Gender-sensitive, student-centered and inquiry-based curricular methods	16	
16.5		
Real life learning adventures the girl child could relate with	50	
51.5		
<b>Total</b>	<b>97</b>	<b>100</b>

The above table shows the frequency of the response obtained from the administered questionnaires. Among the 4 inclusive strategies highlighted, early integration of STEM education at the primary school level has 19.6%, Authentic curriculum that is gender-sensitive has 12.4%, Gender-sensitive, student-centered and inquiry-

based curricular methods has 16.5% while using the real life learning adventures the girl child could relate with has the highest percentage which is 51.5%. Authentic curriculum that is gender-sensitive has the lowest percentage, this may be as a result of the age of the respondents.

**Table 3**

*Factors influencing the underrepresentation of girls in STEM disciplines in Nigeria*

<b>Influencing Factors</b>	<b>Frequency</b>	<b>Percentage</b>
Socio-cultural norms and stereotypes	27	27.8
Self-perceived capabilities	30	30.9
Inadequate resources and funding	24	24.7
Lack of female STEM role models	16	16.5
<b>Total</b>	<b>97</b>	<b>100</b>

The study highlighted 4 major barriers to gender equality in STEM fields in Nigeria. Socio-cultural norms and stereotypes has 27.8%, Self-perceived capabilities has 30.9%, inadequate resources and funding has 24.7% while Lack of female STEM role models 16.5%. Self-perceived capabilities has the highest percentage which implies that the motivation for girl-child interest in STEM Education could result from the perception of self-such as self-confidence, healthy self-concept among others.

## Discussion

The findings shows that using the real life learning adventures the girl child could relate with will promote girls interest in STEM field among other strategies. This is in line with Sammet and Kekelis (2016) findings who advocate for an authentic curriculum that is gender-sensitive and immerses students in real-world experiences. They believe that this will to spark interest and highlight the pragmatic value of STEM fields. This approach aligns with the notion that contextualized learning fosters enthusiasm and dynamism in STEM education. Furthermore, integrating gender-sensitive, student-centered and inquiry-based curricular methods, as documented by UNESCO

(2017), has demonstrated the capacity to enhance girls' self-confidence in STEM domains.

Rosicka (2016) believes that this is importance as it would provide students with positive STEM experiences during their primary education, as this foundation can profoundly impact their subsequent learning trajectories and potential career paths. It remains imperative to deliver comprehensive and effective STEM instruction at this early stage, addressing any gaps in students' STEM knowledge.

The above shows that using the real life learning adventures the girl child could relate with, goes a long way to motivate girl-child in STEM oriented disciplines. This will help them to be motivated they grow up to choose STEM related careers. Also, curriculum should be designed in such a way to encourage real life learning adventures which the students, especially the girl child could relate with. This will foster their interests in learning and choice of career in the future, especially in Nigeria.

Although, girls' engagement with STEM is influenced by various factors, including their self-perceived capabilities, performance, and the societal context they navigate. However, parental expectations, peer interactions, gender-based





stereotypes, and media portrayals as noted by Keane, Linden & Snead, (2022) will be mitigated against if Nigerian curriculum and classroom engagement is tailored towards encouraging real life engagement.

Navigating the developmental trajectory also presents essential considerations. As noted by Wall (2016), interest tends to wane by the age of 6, peer influence starts impacting attitudes by age 12, classroom engagement diminishes by age 14, and performance in STEM subjects declines by age 15. Acknowledging and addressing these developmental dynamics through real life learning engagement would go a long way to spark the girl-child interest in their developmental stages of life. This will also help in sustaining their interest and achievement in STEM fields.

### Recommendation

To enhance girls' interest in STEM Fields in Nigeria, certain efforts need to be put in place. The following recommendations are put forward:

In the first instance, the study proposes the integration of real life learning curricula and pedagogy. This measure is intended to foster hand-on learning environments that are supportive and promoting equitable learning experiences for female students.

Additionally, STEM education needs to be introduced at the early stage of girls' education. The introduction of STEM education at an early stage of schooling will give them firsthand experience. More so, given that a decline in girls' interest in STEM is recorded during their formative years, early introduction of STEM education would serve as the basis for their lifelong learning and career choice.

Again, collaborative efforts involving educational institutions, families, and communities are crucial for the continuous real life learning even after school engagement. This will help to retain knowledge and experience gained within the four walls of classroom.

Mentorship programs and workshops designed to raise awareness about real life learning engagement can offer girls direct interest in STEM professionals, igniting inspiration and ambition. By embracing real life learning engagement, Nigeria has the potential to tap into a valuable resource, narrowing the gender gap in STEM fields and propelling sustainable development.

### Conclusion

This paper investigates the inclusive strategies employed to foster girls' interest in STEM disciplines in Nigerian. While achieving gender equality across STEM domains remains a global challenge, there is a distinct imperative within Nigeria to proactively implement inclusive measures within our educational curriculum and learning methodologies. In this pursuit, the study employs quantitative approach and Intersectionality theory to dissect the multifaceted social identities held by individuals, particularly young girls, which could potentially impede their educational journey and career choices. It was discovered that using Real life learning adventures the girl child could relate with could enhance their interest in STEM related disciplines while Self-perceived capabilities could dampen their interests. Hence, STEM curriculum needs to be designed to encourage more of real life learning than theoretical approach. This will help to boost their interest in STEM discipline.

In conclusion, effecting a transformation in education to foster girls' interest in STEM within Nigeria demands the need for real life learning rather than classroom engagement.

### References

- Abdullahi, N., Abubakar, A., Abubakar, M.J. & Aliyu, C.A. (2019). Gender Gap in Science and Technology Education in Nigeria. *International Journal of Education and Evaluation*. Vol. 5 No. 3
- Agboola, Omowunmi. (2021). *Women and STEM Education in Nigeria: Progress, Shortcomings, Challenges, and Way Forward*. 10.4018/978-1-7998-3814-2.ch011.
- Australian Human Right Commission (2023). *Let's talk about equality and equity*. <https://humanrights.gov.au/lets-talk-about-equality-and-equity>
- Chima, M. (2013). *History of science education in Nigeria*. [www.martinslibrary.com.blogspot.in/2013/03/history-of-science-education-in-](http://www.martinslibrary.com.blogspot.in/2013/03/history-of-science-education-in-)
- Equality and Human Right Commission (2023). *Understanding equality*. <https://www.equalityhumanrights.com/en/se>



- condary-education-resources/useful-information/understanding-equality
- Federal Republic of Nigeria. (2004). *National Policy on Education*.  
[https://planipolis.iiep.unesco.org/sites/planipolis/files/ressources/nigeria\\_national\\_policy\\_on\\_education\\_2004.pdf](https://planipolis.iiep.unesco.org/sites/planipolis/files/ressources/nigeria_national_policy_on_education_2004.pdf)
- FutureLearn (2023). *Promoting gender equality for women in STEM*.  
<https://www.futurelearn.com/info/blog/promoting-gender-equality-for-women-in-stem#:~:text=STEM%20businesses%20need%20to%20prioritise,the%20diverse%20range%20of%20jobs>
- Human Rights Careers, (2023). *10 Causes of Gender Inequality*.  
<https://www.humanrightscareers.com/issues/causes-gender-inequality/#sidr-main>.
- Keane, T., Linden, T. & Snead, S. (2022). *Engaging Primary Girls in STEM*.  
[10.26185/dwfy-wg64nigeria.html?m=1](https://www.dfwy-wg64nigeria.html?m=1)
- Prinsley, R., & Johnston, E. (2015). *Transforming STEM teaching in Australian primary schools: everybody's business*. Australian Government, Office of the Chief Scientist.  
[https://www.chiefscientist.gov.au/sites/default/files/Transforming-STEM-teaching\\_FINAL.pdf](https://www.chiefscientist.gov.au/sites/default/files/Transforming-STEM-teaching_FINAL.pdf)
- Right to Education (2023). *Women and girls*.  
<https://www.right-to-education.org/girlswomen>
- Rosicka, C. (2016). *Translating STEM education research into practice*. Camberwell, Victoria:  
[https://research.acer.edu.au/cgi/viewcontent.cgi?article=1010&context=professional\\_dev](https://research.acer.edu.au/cgi/viewcontent.cgi?article=1010&context=professional_dev)
- Sammet, K., & Kekelis, L. (2016). *Changing the game for girls in STEM: Findings on high impact programs and system-building strategies*. Atlanta, GA.
- Sessou, E. (February 11, 2023). *APWEN says percentage of women, girls in STEM, worrisome*.  
<https://www.vanguardngr.com/2023/02/apwen-says-percentage-of-women-girls-in-stem-worrisome/>
- STEM Women (2022). *Women in STEM Statistics*.  
<https://www.stemwomen.com/women-in-stem-percentages-of-women-in-stem-statistics>
- Ullah R. and Ullah, H. (2019). Boys versus girls' educational performance: Empirical evidences from global north and global south. *African Educational Research Journal* Vol. 7(4), pp. 163-167, October 2019 DOI: 10.30918/AERJ.74.19.036
- UNESCO (2023). *Girls' and women's education in science, technology, engineering and mathematics (STEM)*.  
<https://www.unesco.org/en/gender-equality/education/stem>
- UNESCO. (2017). *Cracking the code: Girls' and women's education in science, technology, engineering and mathematics (STEM)*. In Report. Paris, France: United Nations Educational, Scientific and Cultural Organization.
- UNICEF (2017). *Glossary of Terms and Concepts*.  
<https://www.unicef.org/rosa/media/1761/file/Genderglossarytermsandconcepts.pdf>
- UNICEF (2019). *Girls' education Gender equality in education benefits every child*.  
<https://www.unicef.org/education/girls-education>
- Victorian Government (2023). *Gender equality: what is it and why do we need it?*  
<https://www.vic.gov.au/gender-equality-what-it-and-why-do-we-need-it>
- Wall, J. (2016). A science, technology, engineering and mathematics (STEM) review of the research. *Scan*, 35(2), 27-41.
- World Bank (2023). *Girls' Education*.  
<https://www.worldbank.org/en/topic/girlseducation>
- World Economic Forum (2023). *Gender equality in STEM can support a sustainable economy*. Here's how.  
<https://www.weforum.org/agenda/2023/01/davos23-gender-equality-stem-support-sustainable-economy/>
- World Health Organisation (2023). *Gender and health*.  
[https://www.who.int/health-topics/gender#tab=tab\\_1](https://www.who.int/health-topics/gender#tab=tab_1)