

# Enhancing Interest in Sciences, Technology and Mathematics (STEM) for the Nigerian Female Folk

O. A. Akinsowon<sup>1</sup>, F. Y. Osisanwo<sup>2,\*</sup>

<sup>1</sup>Department of Computer Science, The Federal University of Technology, Akure, Ondo State, Nigeria

<sup>2</sup>Department of Computer Science, Babcock University, Ilishan-Remo, Ogun State, Nigeria

**Abstract** Education for the female folk in general was seen as a waste in the past in Africa. In Nigeria particularly, the girl child is seen as one who would end up in the kitchen. Consequently, little or no attention is paid to her education generally. One of the fall-outs from this is in poor enrollment in school, especially in STEM. This paper reviewed the enrollment status of the female folk in STEM in Nigerian schools. The study also considered the dearth of the female folk in STEM careers. The work reports on the causative factors for the noticed trend and recommending appropriate measures to mitigate the observed gender gap.

**Keywords** Female Education, Gender Gap, STEM, Women in Technology

## 1. Introduction

With the rapid development of technology and increase in the increase in the for information on-the-go, it is imperative that everyone be able to interact with the outside world with little or no external assistance- the women folk inclusive. Considering the alarming percentage of women in the total world population, it is very important to put utmost focus on the education of the women folk [1].

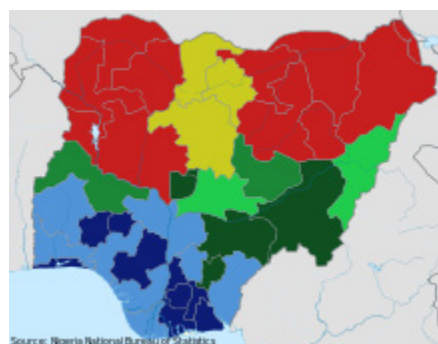
This further corroborates the adage that says that “when you train a woman, you train a nation”. UNESCO, in 1996 designated women and Africa among the priorities of its Medium Term Plan and in this context, launched a six-year Special Project on Scientific, Technical and Vocational Education of Girls in Africa in order to encourage girls to education and allow them to acquire the means to achieve self-dependence [1].

STEM plays an important role in the development of any nation or economy because it forms the basis for the different emerging technologies that the world’s operations are now hinged upon. Hence, the development of girls in STEM cannot be over-emphasized because of the roles they play in the society. The truth is that with more girl-education in Nigeria, we would have a healthier, more educated, more empowered and more productive nation because the girls of today are the mothers of tomorrow [2].

In recent times, there has been a global rise in the consciousness of the impact of gender issues in education

and national development. Hence, it has become imperative to come up with policies at all levels of the economy that would further reduce the gender gap in national development and STEM [3]. However, as much as emphasis are being laid on the need to educate the girl child and the women folk at large, especially in Africa and Nigeria in particular, it ought to be noted that there are a number of factors that can militate against this move. It has been noted by observation and different surveys that throughout the continent, there is a higher record of boys who opt for scientific and technological subjects and the performances of the boys are significantly higher than that of the girls. Eventually when they leave school, the boys are more in pursuit of STEM careers [1].

Women and men tend to take different career paths and the research field is no exception. Overall, women account for a minority of the world’s researchers. Despite the growing demand for cross nationally comparable statistics on women in science, national data and their use in policymaking often remain limited [4].



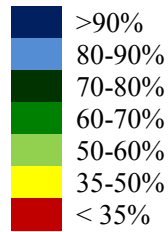
Description of Female literacy rate in Nigeria by state in 2013

\* Corresponding author:

yosisanwo@yahoo.com (F. Y. Osisanwo)

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Source: Nigeria National Bureau of Statistics

Some of the factors that affect female participation in STEM range from societal beliefs and the learning environment, the stereotypic belief that boys are better than girls in STEM, cultural factors which affect the interest of girls in STEM, self-assessment, spatial skills to the bias of associating STEM to the male folk.

## 2. Gender Differences in Interest towards STEM

STEM, by principle, is meant to be progressive. While there has already been a relative paradigm shift towards gender equality, much still needs to be done to accelerate the closing of the ever-present gap in a way that will ensure sustainability. Education about the existence of the imbalance would be a good start. Implementing policies to ensure gender equality in hiring and support for researchers, and establishing tools or media through which gender interest can be enhanced. [5]

Girls are considerably less interested in science subjects than boys, and this can be attributed to the stereotype that it is only for the males or “tom boys”. Thus, being interested in science may threaten the self-perception of girls as well as the femininity of their self-image. Research shows that people have the conception that women in STEM careers are not as good as their male counterparts, except they are extremely and outstandingly good at what they do. This on the other puts the female at a cross-road as her likability tends to diminish because both likability and competence are needed for success in the workplace. [6]

According to [8], the ‘swing away from science’ tendency is common in many countries. In Germany, for example, the percentage of students choosing natural sciences as a major subject has decreased by about 50% within the last 20 years. The dwindling number of students in the UK engaging in scientific fields such as biology, physics, statistics, or information technology has become a matter of great social concern as it is well known that members of these scientific disciplines contribute strongly to a nation’s economic growth and well-being. Furthermore, the swing away from science may potentially cause more concern in the future as there is an ever-increasing need on the job market for individuals who are highly trained in science subjects.

Thus, a lack of interest in science at the high school level may eventually pose a serious threat to economic prosperity. There is worrying evidence to support this theory: When students were asked to rank school subjects according to

personal preference, typically, science subjects are at the lowest ebb. Moreover, compared to other subjects, students’ decreased interest in science subjects is particularly marked and this downward trend is most evident in subjects such as physics and chemistry.

Crucially, there are also considerable gender differences in interest levels in science subjects: Boys are far more likely than girls to claim to like science and the decrease in interest in science amongst girls is even more pronounced than amongst boys. This is somewhat surprising, as nowadays girls on average perform as well as, if not better than boys in many science subjects. Furthermore, even if girls have the same level of competence in science as boys, girls will engage considerably less often in science subjects. Consequently, it might be suggested that the gender gap in interest in science could lead, in turn, to an over-representation of boys in science fields and occupations, a trend that can already be observed and one that will most likely continue in the future. [8]

### 2.1. Factors Causing Lack of Interest towards Science

Despite efforts to give women greater access to education in science and technology in some countries, research shows they are still significantly under-represented in many degree programmes, especially in engineering, physics and computer science. Even with improved access to science and technology education, women have not increased their numbers in the workforce, study finds. In fact, in some countries, including the USA, the number of women in the science and technology workforce is declining. [7]

There are diverse kinds of factors responsible for the gender difference in interest towards science; some of these are discussed;

- **Individual Interest** is a relatively stable individual motivational disposition towards specific objects of interest and is characterized by increased attention and (in most cases) positive effect and emotions. The object of interest could be concrete, a particular content, events, or ideas. Individual disposition towards interest is characterized by the tendency of individuals to re-engage with an object of interest and thus represents a relatively stable person– object relationship. Thus, in the science education context, interest in science represents a student’s enduring disposition to engage in science school subjects (which represent the objects of interest, e.g., physics).

Often girls and women are affected by individual interest as more effort is required of them to have a stable motivation towards science, as most of the sciences are taken in abstract, hence the difficulty to pick interest in the subjects.

- **Situational Interest**, by contrast, is triggered by the environment, and is characterized by a state of actual attraction or curiosity as well as increased attention. Situational interest comprises two phases. The environment plays a larger role in making science interesting for women as various environmental factors could readily discourage girls and women, such as:

- **The teachers' factor**; the perceptions and attitude of teachers teaching in school may be discouraging; this attitude often makes girls to drop out of school. Teachers in some rural part of Africa believe that boys will go to university to take courses like medicine, engineering, architecture and so on, while girls will only study to become secretaries, teachers, designers and so on [9]. This perception or attitude of teachers inform how they teach and attend to the girls in classes especially mathematics and science, and these end up affecting the performance of the girl child. It is on record that one out of every three women in the world is illiterate, meaning that boys are more in the school than girls. There are also established facts that show that teachers' are more attentive to boys and offer them more opportunities for hands-on practical work while the girls are almost ignored or

not given as much attention as the boys. [10]

Even most of the textbooks used for STEM courses use boys as key figures for examples in depicting Science and Technology.

- **The home factor**; balancing family life and personal relationships while achieving a successful career in science is becoming a major challenge for women; this has made some women forgo advancements in their careers in order to devote time to raising a family. The challenges of child care and the demands of running a research laboratory are often seen as incompatible. Women who plan to have children in the future drop out of the academic research race at twice the rate of men. Women are hit hard with family responsibilities just when they need to meet research goals [11].

**Table 1.** Undergraduate enrollment by sex and region in science-based faculties between 1997 and 2006

Undergraduate Enrollment (%) in Science-based faculties by Region												
Year	NE		SW		NW		SE		NC		TOTAL	
	F	M	F	M	F	M	F	M	F	M	F	M
1997	24	76	67	33	15	85	-	-	22	78	32	68
1998	24	76	60	40	22	78	38	62	27	73	34	66
1999	27	73	75	25	23	77	36	64	21	79	36	64
2000	33	67	20	80	29	71	40	60	31	69	31	69
2001	33	67	77	23	30	70	36	34	24	76	46	54
2002	69	31	71	29	21	79	38	62	34	66	47	53
2003	33	67	76	24	21	79	40	60	24	76	39	61
2004	26	74	77	23	29	71	40	60	-	-	43	57
2005	12	88	62	38	40	60	41	59	27	73	36	64
2006	34	66	67	33	31	69	-	-	27	73	40	60

NE – North East; NW –North West; NC – North Central; SW – South West; SE – South East  
Source: [12]

**Table 2.** Undergraduate enrollment by sex and region in Engineering - based faculties between 1997 and 2006

Undergraduate Enrollment (%) in Engineering-based faculties by Region												
Year	NE		SW		NW		SE		NC		TOTAL	
	F	M	F	M	F	M	F	M	F	M	F	M
1997	27	73	23	77	0	100	23	77	12	88	17	83
1998	33	67	23	77	2	98	19	81	15	85	18	82
1999	49	51	26	74	1	99	18	82	14	86	22	78
2000	43	57	15	85	1	99	18	82	11	89	18	82
2001	34	66	34	66	1	99	19	81	12	88	20	80
2002	40	60	50	50	2	98	18	82	17	83	25	75
2003	27	73	42	58	4	96	22	78	16	84	22	78
2004	21	79	48	52	2	98	23	77	-	-	24	77
2005	25	75	53	27	4	96	-	-	80	20	41	60
2006	23	77	55	45	5	95	-	-	17	83	25	75

NE – North East; NW –North West; NC – North Central; SW – South West; SE – South East.  
Source: [12]

In many African countries, girls' exclusion from science can be attributed largely to the construction of feminine identities, ideologies of domesticity and gender stereotypes. Formal and informal socio-cultural norms and expectations about the role of females in society have tremendous effects on girls' educational opportunities, learning outcomes and decisions about study and work. [12]

- **Curriculum Development;** can also play a role in signaling who belongs in the major. Using Computer Science as an example, the early focus on programming in the curriculum can serve as a discouragement to females and even males. The unfortunate part is that they may have been interested in other broader, multidisciplinary applications in Computer Science but the first encounter could have killed their overall interest- such that they won't even wait to know that there is more to Computer Science than programming. [6].

The tables above show the enrollment of students, both male and female for the period of ten years in different zones of Nigeria. Even though the margin in Science courses are smaller than the very wide gaps that exist in the Engineering courses, it is still obvious that the female folk is under-represented. However, it must be noted that the margin reduced significantly as the years go by. It is still an issue to be addressed.

### 3. Closing the Gender Gap

To reduce the existing gap in gender representation in STEM in Nigeria and encourage the women folk to choose careers in STEM, the following issues would need to be addressed:

1. Adequate preparation of the girl for STEM. Good maths skills are essential for success in STEM, hence they must be intimated of the need for maths and encouraged to face it with a mindset of being able to handle it well. The teachers are to be trained on how to relate with the female students who may be starting off with the fear of the pre-conceived notion of STEM.

2. The perception that STEM is primarily meant for the males needs to be corrected. This would require promoting a positive image of women in STEM.

3. The society should be sensitized on the importance of removing all gender bias and stereotypes, especially parents, curriculum developers, school administrative staff, educators and trainers.

4. Early exposure of girls to female role models who have excelled in their STEM careers and equally doing well as mothers and wives. Also by counseling them on the prospects of STEM careers and improving access of girls to scientific and technological education. This can be done by organizing career fairs, job shadowing, career talks, enterprise education, workplace and science centre visits and making career publicity materials available to them. [1]

5. Scholarships and Awards for women in STEM will

further reduce the gap that exists between the genders. There are a number of international bodies that are actively supporting women and giving females special consideration. For example, some of the conditions for most scholarship opportunities for female Phd students are pegged at higher ages as against lower ages for their male counterparts. There are also some bodies and associations that are dedicated to females only: Anita Borg Scholarship, Grace Hopper Celebrations for Women In Computing, Schlumberger Foundation Faculty For The Future and some that are for both males and females; The World Bank-funded Science and Technology Education Post-Basic (STEP-B) Project, Exxon Mobil Education Initiatives (MPN), Schlumberger Excellence in Education Development (SEED), Strengthening Mathematics and Science Education Project (SMASE) and so on.

6. Introduction of Competency-Based Learning activities into the teaching of STEM. By this, the courses are seen as tangible, instead of being abstract. This will also help the spatial skill of the girls and make the learning environment of STEM more attractive.

7. Active mentoring and role-modelling. This can be of very strong impact on the female being modeled because it helps to build confidence and clear the gender stereotype that had been attached to STEM. Studies have shown that mentoring programs between secondary and primary schools can led to improvements in students' academic performance, attitudes and self-confidence, while mentors also report learning from their mentees. Secondary school aged girls who enjoy science subjects could serve as mentors for younger girls in primary school. Similarly, female scientists could serve as mentors for girls of university age, who could serve as mentors for girls in secondary school. These layers of mentoring can benefit both the mentors, as they develop leadership skills and receive advice and encouragement, and the mentees, as they learn from someone who has faced similar obstacles relatively recently. [13]

Historically, boys have outperformed girls in maths, but in the past few decades the gender gap has narrowed, and today girls are doing as well as boys in math on average Girls are earning high school math and science credits at the same rate as boys and are earning slightly higher grades in these classes [14].

### 4. Conclusions

With the flexibility and availability of e-library, interest of female in Science Technology can be beefed up. Women who because family commitment drop out of science can now plan their schedule to suite them readily since e-library is always available. Training kits or science activity packages offered by some multimedia resources will encourage girls to pick more interest in science education. These technologies can also improve the performance of girl child in Science Technology and Mathematics (STM)

and increase the population of women in the field of Science.

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## REFERENCES

- [1] UNESCO (2006), "Girls and Science- A training module on motivating girls to embark on science and technology careers", Section for Science and Technology Education Division of Secondary, Technical and Vocational Education.
- [2] British Council, Nigeria (2012), "Improving The Lives Of Girls and Women In Nigeria", Gender n Nigeria Report 2012, Issues, Policies, Actions, 2nd Edition.
- [3] L. I. Aguele and U. N. V. Agwagah, "Female Participation in Science, Technology and Mathematics (STM) Education in Nigeria and National Development", J. Soc. Sci., 15(2): 121-126 (2007).
- [4] UNESCO (2013), "Women In Science", UIS Fact Sheet, No.23.
- [5] Z. Payam (2013) "Closing the Gender Gaps for Women in Science", Immpress Magazine.
- [6] C. Hill, C. Corbett and A. St. Rose, "Why So Few?", Women in Science, Technology, Engineering and Mathematics, Published by AAUW, Library of Congress Control Number: 2010901076, ISBN: 978-1-879922-40-2.
- [7] Research Information (2012) "Gender inequality continues in science and technology", [Online] Available: <http://www.researchinformation.info>.
- [8] K.Slyvie, M. Romain and B. Martin (2011) "How can we enhance girls' interest in scientific topics?" British Journal of Educational Psychology.
- [9] N. Angeline (2011), "Girls, Schools and Statistics Education in South Africa", First Africa Young Statisticians conference, [Online] Available: <http://www.statssa.gov.za/ycs>.
- [10] UNESCO (1999), "Women, Science and Technology", Towards A New Technology.
- [11] S. Pappas Stephanie (2013) "Science Gender Gap: Five Reasons Women Trail Men In Science", Live Science [Online] Available: [http://www.huffingtonpost.com/2013/03/07/science-gender-gap-five-reasons-women-men\\_n\\_2827567.html](http://www.huffingtonpost.com/2013/03/07/science-gender-gap-five-reasons-women-men_n_2827567.html).
- [12] H. O. Aderemi, O. M. Hassan, W. O. Siyanbola and K. Taiwo (2013) "Trends in enrollment, graduation and staffing of science and technology education in Nigeria tertiary institutions: A gender participation perspective", Vol. 8(21), pp. 2011-2020, ISSN 1990-3839© 2013, Academic Journals, <http://www.academicjournals.org/ERR>.
- [13] A. Ekine and N.A. Abay, "Enhancing Girls' Participation in Science in Nigeri: A Driver for National Development and Social Equality Center for Universal Education".
- [14] US Department of Education, Institute of Education Sciences, National Center for Education Statistics, <http://nces.ed.gov/>.