

Participation of Rivers State Tertiary Education Female Students in Science, Technology, Engineering, and Mathematics (STEM) and Their Expected Career Choices.

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Abstract

This study focused on predisposing factors of females to STEM education, expected career choice for females, and strategies for change. Random sampling was used, and (10) 10 tertiary institutions were selected among the eleven (10) tertiary institutions within the area of study. All the students within the selected tertiary institutions constituted the population of the study. A total of three hundred (300) students were selected from ten tertiary institutions in the Port-Harcourt metropolis, which constituted the sample of the study. The instrument for data collection was a quantitative-structured questionnaire. The questionnaire consists of (24) twenty-four items with (3) three sections to reflect the three areas of focus of the study. Content and face validity were employed, and a reliability index of 0.75 was achieved after a trial test. Descriptive statistics and mean ratings were deployed. Among others, the main predisposing factor is that females are not favourably considered when it comes to employment, expected career, and educational choice. This accounts for the significantly reduced female interest in STEM. Parents, society, tradition, and culture were identified as critical drivers of this gender discrimination. Females, however, should be allowed to pursue their choice of career whether or not in STEM. Findings also revealed that strategies for change are; rewards, incentives, grants, and subsidized education for females in STEM.

Keywords: *Career choice, Gender discrimination, predisposing factors and strategies, STEM.*

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I. Introduction

Education has been recognized in Nigeria as a vital and powerful tool for political, economic, and social change in many other countries. According to the national policy on education, the ‘Federal Government of Nigeria has adopted education as an instrument par excellence for effective national development’ Women and men have significant roles to play in national development. For compelling performances of these roles, both genders need education; gender should not be considered a barrier to education. Science, Technology, Engineering, and Mathematics (STEM) have been identified as the bedrock for national development. In this era of globalization, job vacancies are dominated by STEM-seeking skills. In Southeast Nigeria, there is a common saying, “educate a boy, and you educate a single person. However, educate a girl, and you educate a nation.” Despite progress towards gender equity in the global education system, great discrepancies persist within nations and across regions. Far too few girls are in school, and far too few pursue studies of their choice. This is a precise concern in STEM, as it records even fewer women¹.

It is no secret that Science and Technology are the key drivers of development, and as a developing nation, this more than anything should matter to Nigeria. This concern arises from the increasing recognition that Nigeria cannot advance as quickly as it aspires without generating an adequate pool of scientific and technological human resources at all levels. However, it is being speculated that females’ enrollment and performance in STEM have been relatively low in Nigeria². For a nation to develop progressively and rapidly, having the most capable hands to steer the helm of affairs irrespective of gender should be our ultimate goal. The low proportion of women in science and Technology has philosophical, social, and economic implications. It is estimated that women constitute more than 50% of the Nigerian population (leaving the remaining less than 50% to be shared between children and men). This, by translation, could mean their under-representation in any aspect of education would amount to losing the contribution of more than half of the country’s population. Therefore, it is appropriate to state that the country’s development would be incomplete without women.

STEM can be seen as a cord of four facets that are intertwined and interdependent. Advances in one field result in development in the other. United States Department of commerce categorically stated that STEM occupations are growing at 17% while other occupations are growing at 9.8%. STEM graduates have a

higher income even if they are in non-STEM careers. Studies involving the number of females in mathematics within South Western Nigerian Universities have the following result; the ratio of male to female lecturers was approximately 16:1, a ratio of males to females enrolled at the undergraduate level was 2:1, while at the postgraduate levels the ratio of was 6:1³. Therefore, it is important to understand how worrisome the trend of low female participation is and its adverse effect on the economy.

Whether and a difference in cognitive ability between men and women have always been debatable, but no clear conclusion has ever been made⁴. Among other reasons, loss of interest strikes as one of the primary reasons girls decide against a STEM career. However true, this choice is significantly influenced by the socialization process and pre-defined gender roles, including stereotypes⁵. Gender stereotypes, unfortunately, communicate that STEM careers are for the male child and that girl child is weak and by nature supposed to be soft. This ill-believed ideology further sways the girl child away from STEM⁵. Africa parents and culture are also not helping enough to change the narratives, as UNESCO's assessment of female participation in science and Technology showed that Africa has the lowest female participation, far below every other region of the world⁶. By translation, parents like the society (by virtue of culture and religion) have a strong opinion on what kind of interest the girl child picks and her participation in the chosen part. These practices include the enforcement of girls into early marriage and early childbearing giving. Gender mainstreaming legislation is now employing incentives to increase females' participation in STEM education and careers. Therefore, this study was necessary to study female interest in STEM and understand what drives their decision to or against it.

Furthermore, this study was inspired by the historical underrepresentation of Nigerian ladies in STEM. Statistics show that in the tertiary institution only hand full of ladies are in Physics (19%), Engineering (20%), and Computer Science (18%) (National Science Foundation, 2015), and this continues even to workplaces, with women constituting 12% of physicists/ astronomers, 15% of engineers and 24% of computer and information Scientists⁷.¹ Stated that ladies represented only 33% of STEM students globally.

II. Methodology

The study adopted a survey research design involving questionnaires, analyzed using descriptive statistics and mean rating. The well-structured yet simple questionnaires were strategically distributed to the female student in the Port Harcourt metropolis at ten selected tertiary institutions. The institutions were selected based on population, the field of specialization, and student's popular choice. The students were reluctant to complete the questionnaires; hence the sampled data only constituted three thousand completed questionnaires. Research Questions include:

1. What are the expected career choices of females in tertiary institutions in the Port Harcourt metropolis?
2. What are the factors predisposing females in tertiary institutions in Port Harcourt metropolis to STEM?
3. What are the strategies for enhancing Nigerian females' participation in STEM in tertiary institutions in the Port Harcourt metropolis?

The questionnaire involved twenty-four quantitative items and three sections (representing the three key research questions). Section one (1) contained six (6) closed type questions designed to draw information from the respondents concerning the factors predisposing females to STEM; section two (2) contained thirteen (13) questions designed to elicit information from students concerning the expected career choice for females; while section three (3) contained five (5) questions designed to elicit information concerning the strategies for enhancing females' participation in STEM. All the items for evaluation were rated on a 5-point scale which includes; strongly disagree, disagree, undecided, agree, and strongly agree

The choice of words and sentence structures of the questionnaire was subjected to expert reviews. The test-retest method was adopted to establish the reliability of the instrument used in this study. The questionnaires were first administered to selected female undergraduates within three (3) months intervals on two different occasions. Both data were analyzed independently with a person product-moment correlation technique yielding a reliability index of 0.75. Hence, the instrument was believed to be reliable.

The data collected were analyzed using descriptive statistics and mean ratings. These were done mainly based on the computation of the extent (proportion) of response to each text item within item members in the question.

III. Results

Research Question 1

what are the expected career choice for females in tertiary institutions in the Port Harcourt metropolis?.

Table 1: The Expected Career Choice for Females

		SA	A	UN	D	SD	∑f	∑fX	X	Remarks
1.	Females should go into STEM career	1100	790	110	330	670	3000	10320	3.4	Agree
2.	Females should go into careers outside STEM	410	490	250	890	960	3000	7500	2.5	Disagree
3.	Females should be encouraged to pursue their choice of careers whether or not in STEM	990	950	280	350	430	3000	10720	3.6	Agree
4.	Females should be encouraged not to involve in any careers at all	300	250	160	690	1600	3000	5960	2.0	Disagree
5.	Females should be encouraged to pursue careers in the field of arts and humanities	600	640	500	600	660	3000	8900	3.0	Agree
6.	Females should be encouraged to pursue careers in Home management/family life	770	710	140	650	730	3000	9140	3.0	Agree

Table 1 shows the undergraduate students’ expected career choice for females as follows: They believe that females should pursue their choice of career whether or not in STEM [X = 3.6]; that females should go into STEM career [X= 3.4]; they are also of the opinion that females should pursue their career in Arts and Humanities as well as in Home Management/Family life [X = 3.0].

Research Question 2

What factors predispose females in tertiary institutions in Port Harcourt metropolis to STEM?.

Table 2: Factors Predisposing Females to STEM.

S/N	Statement	SA	A	UN	D	SD	∑f	∑fx	X	Remarks
1.	Females are afraid of coping with the demands of STEM careers as married women and mothers	320	200	480	990	1010	3000	6930	2.3	Disagree
2.	Females are not favourably considered when it comes to employment	700	890	410	680	320	3000	9970	3.3	Agree
3.	Females have reduced marriage opportunities if they go for STEM.	220	400	240	1050	1090	3000	6610	2.2	Disagree
4.	Females do not have many role models in STEM to influence girls choice of careers in STEM	780	750	170	690	610	3000	9400	3.1	Agree
5.	Females go along with societal values and expectations in all their endeavours	400	420	210	990	980	3000	7270	2.4	Disagree
6.	Females are deliberately counseled out of STEM jobs	610	660	360	770	600	3000	8910	3.0	Agree
7.	Religious beliefs and practice about women affect females’ aspirations and ambitions	840	670	390	560	540	3000	9710	3.2	Agree
8.	Females in STEM usually experience fear, hatred, and natural dislike from their male colleagues and subordinates	760	700	130	600	810	3000	9000	3.0	Agree
9.	Females possess low intellect and cannot grasp abstract science concepts as we have in STEM	370	500	280	980	870	3000	7520	2.5	Disagree
10.	Females lack creative disabilities and original thinking as is needed in STEM	230	470	480	1060	760	3000	7350	2.5	Disagree

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11.	Females undergo socialization from childhood that leads them to developing personality (e.g dependence)	560	440	1000	370	630	3000	8930	3.0	Agree
12	Females are being socialized into accepting subjects and jobs said to be “fit for females,” and this is bad for STEM	660	630	440	670	600	3000	8980	3.0	Agree
13	Females do not like long periods of training which characterize mostSTEM jobs	250	300	200	1010	1240	3000	7320	2.4	Disagree

Table 2 shows undergraduate students’ perception of factors predisposing females to STEM. The most significant among them is the fact that, females are not favourably considered when it comes to employment [X = 3.3]; religious beliefs and practices about women affect females’ aspirations and ambitions [X = 3.2] and there are not many female role models to influence females career choice in STEM [X = 3.1].

Research Question 3

What are the strategies for enhancing females’ participation in STEM in tertiary institutions in the Port Harcourt metropolis?

Table 3: Strategies for Enhancing Females’ Participation in STEM

S/N	Statements	SA	A	UN	D	SD	∑f	∑fX	X	Remark
1.	Females should be encouraged to study STEM courses through awareness programmes and science projects & competitions	1570	830	230	290	80	3000	12520	4.2	Agree
2.	Females should be encouraged into STEM by giving them rewards and incentives as well as Research grants	1280	1030	90	330	240	3000	11540	3.8	Agree
3.	Female graduates in STEM should not be discriminated against in employment.	950	1000	300	450	300	3000	10850	3.6	Agree
4.	The Saying that women’s education ends in the kitchen should be vigorously campaigned against.	1840	750	160	200	50	3000	13090	4.4	Agree
5.	There should be free education to females in the field of STEM and automatic employment immediately after graduation	1750	500	300	250	200	3000	12350	4.1	Agree

Table 3 shows the undergraduate students’ perception of strategies for enhancing females’ participation in STEM. Students unanimously agreed that “women’s education ends in the kitchen” should be vigorously campaigned against [X = 4.4] and that females should be encouraged to study STEM courses through awareness programs and science projects & competitions [X = 4.2].

IV. Discussion

On the expected career choice for females, students agreed that: Females should be encouraged to pursue their choice of career whether or not in STEM; Females should go into STEM careers; Females should be encouraged to pursue careers in the field of Arts and Humanities, as well as in Home management/Family life. On the other hand, students were in disagreement that Females should go into a career outside STEM and that females should be encouraged not to involve in any career at all.

Students agreed that females were not favourably considered concerning employment. Religious beliefs, among others, negatively affect females’ aspirations and ambitions. There were few female role models to influence female’s career choices in STEM. Females were deliberately counseled not to take up STEM careers/courses; females in STEM also experience fear, hatred, and natural dislike from their male colleagues and subordinates. Females are being socialized into accepting subjects and jobs said to be “fit for females.” These are in agreement with some researchers’ findings. Gender discrimination in employment is one of the factors contributing to gender inequality in the pursuit of STEM⁸. Many (including female) employers sometimes prefer employing males to females. Certain cultural and religious practices are against female

enrollment in formal education, which automatically eliminated them from the chances of studying and participating in science. These practices include the second-rated status traditionally ascribed to females, the enforcement of girls into early marriage as a means of avoiding moral and sexual contamination, the mandatory separation of females from public glare; Culture and social norms influence females' perception about their abilities, roles in the society and career as well as life aspirations. Parents also contribute to females' lack of involvement in STEM, early marriage, and other domestic duties have ended most Nigerian girl-child educational dreams. Among the items that students disagreed on are:

1. Females go along with societal values and expectations in all their endeavors
2. Females possess low intellect and cannot grasp abstract science concepts
3. Females lack creative abilities and original thinking as is needed in STEM
4. Female's chances of very late marriage increase if they go into STEM.

Males performed better than females in subjects requiring quantitative ability, males show superiority in science, statistics and accounting⁹. Loss of interest has been the primary reason females opt out of STEM; this choice is influenced heavily by the socialization process and stereotyped ideas about gender⁵.

On the strategies for enhancing females' participation in STEM, students agreed that: females should be encouraged to study STEM courses through awareness programs and science projects/competitions; females studying STEM courses in tertiary institutions should be encouraged by giving them rewards and incentives as well as research grants; female graduates should not be discriminated against in employment, there should be equal opportunities to both sexes; The Saying that women's education ends in the kitchen should be vigorously campaigned against; females in the field of STEM should be given free education as a motivating tool; as well improved employment in the industry. Gender mainstreaming legislation or policies such as quotas and incentives can increase females' participation in STEM education and career.

V. Conclusion

The study of STEM in Nigeria is now a matter of great concern to all; this concern arises from the increasing realization that no nation can develop as rapidly as it aspires without creating an adequate pool of STEM human resources at all levels in her population. Females should pursue their career choice whether or not in STEM; however, they should be encouraged more to venture into STEM since society, culture, religion, and ill-disposition have historically placed her paces behind their male counterparts. Strategies for enhancing females' participation in STEM should include giving rewards and incentives, research grants, and free education, creating awareness through awareness programs, and involving the students in healthy competitions and science projects. There should be no discrimination in employment; instead, employment placements should be strictly merit-based with gender inclusion in mind. All stakeholders involved (teachers, government, society, religious leaders, parents) should take necessary steps to overturn the status quo and encourage more female participation in STEM.

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