Gender Imbalance in Stem Programs in Nigeria

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Abstract. Gender imbalance in Science, Technology, Engineering, and Mathematics (STEM) education is a persistent global challenge, particularly in Nigeria, where societal and institutional factors often limit women's participation in these fields. This study investigates the gender disparities in enrollment across STEM programs at the University of Agriculture, Makurdi, over four academic sessions (2009–2013). Using secondary data analysis and theoretical insights from Bandura's Social Cognitive Career Theory, the research examines the enrollment trends of male and female students in selected STEM programs. Findings reveal significant gender imbalances, with male students consistently outnumbering their female counterparts in Mathematics, Computer Science, and Statistics programs.

In contrast, Biology Education exhibited near gender parity. The results suggest that societal stereotypes, self-efficacy perceptions, and parental influence significantly shape career choices, perpetuating the underrepresentation of women in STEM. The study highlights the need for targeted interventions to address systemic barriers and promote gender equity in STEM education in Nigeria and beyond.

Keywords: STEM Education; Gender Imbalance; Gender Equity; Career Choices; Program Enrollment Trends; Social Cognitive Theory.

INTRODUCTION

Education is a catalyst that helps to reshape an existing culture and also helps to prepare students for the future. The full importance of education can be gotten only when there exists no bias on the gender concepts that a society holds. For radical change to occur, female foxes must be motivated to develop an interest in all science programs, especially in areas known to be the realm of men alone. For social transformation to happen, there is the need for both formal and informal education to address the gender imbalance in society that prevents females from being at their very best in the developmental race. Education should be able to impact knowledge and the skill set necessary for family life and participation in a society's development [1].

When a country educates its citizens, economic growth rises, infant and maternal rates fall, the fertility rate decreases, and the health and educational prospects of the next generation are increased [2]. In 1947, the United Nations established the Commission on the Status of Women (UN-CSN), which is dedicated solely to gender equality and advancement in the UN member states. The Action platform of the Fourth UN World Conference on Women, 1995, stated that women's empowerment and full social participation are essential for achieving equity, peace, and development. The World Conference on Education For All (EFA), conveyed in Joulien, Thailand, in April 1990, declared the goal of primary education. The conference delegates affirmed that education is a fundamental human right for both genders worldwide. The National Policy on Education in Nigeria, 1998 also emphasised equal educational opportunities for her citizens, irrespective of gender, religion, social class, or ethnic affiliation.

Gender has become a social challenge that has attracted much concern. Consequently, the school system and career aspirations created a wide gap between males and females. Developed nations are working to get more women into science and engineering to utilise their talents and

provide personal satisfaction and intellectual challenge for the women involved while overemphasising gender disparity at the expense of numerous biological and physical similarities that should have been considered for social harmony and economic growth [3]. The issue of gender equality is a crucial thing in science education, especially with increasing demand on how to boost the workforce for technological advancement as well as increasing the population of women in Science, Technology, Engineering, and Mathematics. Gender equality entails the concept that all human beings, both male and female, are at liberty to make choices without the barriers of gender stereotypes, rigid gender roles, and bias.

Researchers have reviewed that there is still low women participation in science education as compared to men's involvement in science education. The issue of scientific and educational development in Nigeria needs the contribution of both genders; hence, there is a need to enhance science education in Nigeria. At the University of Agriculture Makurdi, there has been no empirical evidence that proves that there is a gender imbalance in STEM programs. This study was undertaken due to complaints from different sections of society that the University of Agriculture Makurdi favours male students during the admission process. In this regard, the researcher wants to know if this claim is valid with the University of Agriculture Makurdi.

Theoretical framework

This research is based on Bandura's Social Cognitive Career Theory (SCCT). This theory states that an individual's confidence to excel in a given situation or to accomplish a task determines their willingness and desire to pursue a career path. That is to say, a person's biology, such as gender and race, constantly interacts with some social factors (culture, family) and the learning outcomes to influence their self-efficacy. Self-efficacy influences interests, goals, actions, and final attainments. Job opportunities, access to training, and financial resources influence individuals' career choices.

Factors Affecting Career Choices. Choosing a career path is sometimes challenging; it involves some interconnected factors that make it difficult to choose one. According to the authors [4], the environment in which an individual lives, talents, skills, and academic achievement is essential in choosing a career. When an individual eventually makes a mistake in terms of career choices, it leads to regrets, failure, and disappointment. Research shows that homes, schools, and social stratification influence an individual's career choice. Financial prospects are a crucial factor determining men's career paths as they must meet household expenses, whereas women show more concern for social values and utility [5]. Factors such as aptitude, life circumstances, and academic achievement influence an individual's career path [6]. Socio-economic factors also motivate students to make career decisions [7]. A comparative study by authors [8] reports that students from poor socio-economic backgrounds made wrong career decisions and chose professions requiring short training due to financial difficulties. Students who fare well academically have better career prospects and choices than special students. Authors [9] assert that a well-read person has more information related to career choice and reads more to make crucial decisions. Thus, their decisions are likely to be wise and correct. Parents must emphasise their role in the lives of children.

Parental Pressure. Choosing a career to live up to their parent's expectations is the most common decision made by students in taking a career path to please their parents at an early stage, which they tend to regret later. Most students whose parents are health professionals may choose career paths related to the health profession. Families are by default expected to select health and hence MBBS, B.Ph., Nursing, etc., as their suited career path – some resist submission to parental pressure, leading to an unsuccessful career graph.

The Gender Stereotype. Gender stereotypes are another factor that plays a vital role in students' career paths. Some researchers analysed the gender stereotypes of math and other science programs through different quantitative and qualitative methods, as reviewed by authors [10] using the Draw-A-Scientist Test (DAST). In the DAST method, researchers reported that kindergarten to high school students perceive a scientist as male. Most children's paintings of scientist portrayals portray a scientist as a male person, and only a few of the children's paintings portray a scientist as a female person. For example, in a study among students from kindergarten through fifth grade, there were only 28 pictures of a female scientist out of 4,807, and all of these 28 drawings were drawn by girls [11]; in a study

surveying students in grades 2–12, only 135 pictures out of 1,600 displayed female scientists and only six out of 135 photos of a female scientist were drawn by male students [12].

Research work that was reviewed shows that among adolescent youths, female students show a more pronounced gender stereotype for mathematics than male students, who are less likely to exhibit implicit gender-stereotypic associations [13]; this is In line with a study by authors [14], which reported that even women who had selected majors that involved mathematics had difficulties associating mathematics with themselves because they associated mathematics with male gender.

Self-efficacy. This is another decisive factor that contributes significantly to one's career choice. Self-efficacy is the confidence one has in one's ability to achieve goals, and it develops from earlier experiences and verbal persuasions attributable to the upbringing environment. Research has shown that men are more oriented towards STEM programs than their female fox. Nicole Joseph, assistant professor of mathematics education, believes that math is reserved for the elite group of students, and either you can do it or you cannot.

The *study aims* to analyse gender enrollment under the College of Agriculture and Science Education for four academic Sessions (2009/2010, 2010/2011, 2011/2012, 2012/2013) at the University of Agriculture Makurdi. Specifically, the aims of this research are to:-

1) To ascertain the enrollment level of male students in the Department of Science Education.

2) To verify the enrollment level of female students in the Department of Science Education.

3) To compare the enrollment status of both genders in science education.

Researchers raised the following questions to guide this research:

1) What is the percentage of male enrollment in the selected disciples?

2) What is the percentage enrollment of female students in selected disciples under study?

3) What is the relationship between male and female enrollment status in the science education department?

METHOD

The research used secondary data for the analysis. The researchers accessed the needed data through the Department of Science Education student records. The researcher used a balloting system to select the required programs and judgmental sampling to choose the years to be reviewed. The study used a sample size of 1,644 students admitted to the selected programs for the years under study.

RESULTS AND DISCUSSIONS

Research question 1: What is the percentage of male enrollment in the selected disciples?

The university admitted 131 male students into the B.Sc. (Ed) Statistics/Computer Science program during the 2009/2010 academic session, accounting for 77.06% of the total 170 students admitted.

Table 1 – Percentage Enrollment of Male Students into Selected Programs in the Department of Science Education in the Period of Four Academic Sessions

Programs	Academic Session	Number Enrolled	% of enrollment
B.Sc. (Ed) Statistics / Computer Science	2009/2010	131	77.06
	2010/2011	121	85.82
	2011/2012	62	79.49
	2012/2013	39	82.98
B.Sc. (Ed) Mathematics / Computer Science	2009/2010	134	82.72
	2010/2011	39	82.98
	2011/2012	67	88.16
	2012/2013	34	72.34
B.Sc. (Ed) Biology	2009/2010	72	49.32
	2010/2011	60	51.72
	2011/2012	48	50.00
	2012/2013	24	43.64
B.Sc. (Ed) Mathematics / Statistics	2009/2010	168	81.55
	2010/2011	96	90.57
	2011/2012	89	83.96
	2012/2013	35	77.78

In the 2010/2011 academic session, 141 students were admitted to study the program, of which 121 were male, representing 85.82% of the total number of students admitted. In the 2011/2012 academic year, 78 students were admitted to the program, of which 62 were male, which gives 79.49% of the total number of students admitted into the program. In the

2012/2013 academic year, 39 out of 47 students admitted into the program were males. This figure indicates an acceptance rate of 82.98% for male students. Thus, more male students have been offered admission to study B.Sc. (Ed) Statistics/ Computer Science.

In B.Sc. (Ed) Mathematics/Computer Science, 162 students were admitted in the /2010 academic year, of which 134 were male, representing an 82.72% acceptance rate for male students. In the academic year of 2010/2011, 39 out of 47 students admitted into the program were male, indicating an acceptance or admission rate of 82.98% for male students. In the 2011/2012 academic year, 67 out of 76 students admitted to study the program were male students, and this represents 88.16% of the total number of students admitted into the program and in the academic year of 2012/2013, 72.34% of the total number of students (47) admitted to study the program were male students. Based on the above values, more male students were admitted to study B.Sc. (Ed) Mathematics/Computer Science.

In the 2009/2010 academic year, 146 students were admitted to study B.Sc. (Ed) Biology, of which 72 were male, representing 49.32% of the total number of students accepted for the academic year. In the 2010/2011 academic year, 51.72% of the total 116 students admitted to study Biology Education were male students; in the 2011/2012 academic year, 50% of the total 96 students into Biology Education were male students. In the 2012/2013 academic year, 55 students were enrolled in Biology Education, of which 24 were male. This figure represents a 43.64% acceptance rate for male students. There has been average acceptance for male students into Biology Education for the academic years under study.

The university admitted 206 students to the Mathematics/Statistics Education program, including 168 male students. This figure represents an 81.55% acceptance rate for male students in 2009/2010. In the 2010/2011 academic year, a 90.57% acceptance rate for male students was recorded. The total number of students admitted to mathematics and statistics in this academic year was 106, of which 96 were male. In the 2011/2012 academic year, the school admitted 106 students to mathematics and statistics education, of which 89 were male, giving an acceptance rate of 83.96%. In the 2012/2013 academic year, 77.78% of students enrolled in mathematics and statistics education were male.

Research question 2: What is the percentage enrollment of female students in the selected programs?

The above table shows a representation of the acceptance rate of female students in percentage for the academic years under study.

Table 2 – Percentage Enrollment of Female Students into Selected Programs

Programs	Academic Session	Number Enrolled	% of enrollment
B.Sc. (Ed) Statistics / Computer Science	2009/2010	39	22.94
	2010/2011	20	14.18
	2011/2012	16	20.05
	2012/2013	8	17.02
B.Sc. (Ed) Mathematics / Computer Science	2009/2010	28	17.28
	2010/2011	8	17.02
	2011/2012	9	11.84
	2012/2013	13	27.66
B.Sc. (Ed) Biology	2009/2010	74	50.68
	2010/2011	56	48.28
	2011/2012	48	50.00
	2012/2013	31	56.36
B.Sc. (Ed) Mathematics / Statistics	2009/2010	38	18.45
	2010/2011	10	9.43
	2011/2012	17	16.04
	2012/2013	10	22.22

The university admitted 39 female students to the B.Sc. (Ed) Statistics/Computer Science program during the 2009/2010 academic session, representing 22.94% of the total 170 students admitted. In the 2010/2011 academic session, 141 students were admitted to study the program, of which 20 were female, representing 14.18% of the total number of students admitted. In the 2011/2012 academic year, 78 students were admitted to the program, of which 16 were female, giving 20.05% of the total number of students admitted. Moreover, in the 2012/2013 academic year, 8 out of 47 students admitted into the program were female. This figure indicates an acceptance rate of 17.02% for male students. Thus, the table above shows that the university admits fewer female students to the B.Sc. (Ed) Statistics/Computer Science program.

In B.Sc. (Ed) Mathematics/Computer Science, 162 students were admitted in the 2009/2010 academic year, of which 28 were female, representing a 17.28% acceptance rate for female students. In the academic year of 2010/2011, 8 out

of 47 students admitted into the program were female, giving an acceptance rate of 17.02% for female students. In the 2011/2012 academic year, 9 out of 76 students admitted to study the program were female, representing 11.84% of the total number of students accepted into the program. In the academic year of 2012/2013, 27.66% of the total number of students (47) admitted to study the program were female students. Based on the above values, female mathematics/computer science students are less represented.

In the 2009/2010 academic year, 146 students were admitted to study B.Sc. (Ed) Biology, of which 74 were female, representing 50.68% of the total number of students accepted for the academic year. In the 2010/2011 academic year, 48.28% of 116 students admitted to study biology education were female students. In the 2011/2012 academic year, 50% of 96 biology education students were female. In the 2012/2013 academic year, the university enrolled 55 students in the biology education program, including 31 female students. This figure represents a 56.36% acceptance rate for female students. There has been an average representation of female students in biology education for the academic years under study.

In Mathematics/Statistics Education, 206 students were admitted to study the program, of which 38 were female. This figure represents an 18.45% acceptance rate for female students in 2009/2010. In the 2010/2011 academic year, a 9.43% acceptance rate for female students was recorded. The total number of students admitted to mathematics and statistics this academic year was 106, and 10 were female. In the 2011/2012 academic year, the school admitted 106 students to mathematics and statistics education, of which 17 were female, giving an acceptance rate of 16.04%. Moreover, in the 2012/2013 academic year, 22.22% of students enrolled in mathematics and statistics education were female. These figures show that female students have been underrepresented in mathematics and statistics education for the years under study.

Research question 3: What is the relationship between the percentage enrollment for both genders for the academic years under study?

In Statistics/Computer Science Education for the academic years under study (2009/2010, 2010/2011, 2011/2012, 2012/2013), 80.96% of the total students enrolled to study the program were male, whereas 19.04% were female; this indicates the underrepresentation of female students in this field of study. 82.53% of the total number of students admitted to Mathematics and Computer Science Education for the years under study were male students, and 17.47% were female students. This figure indicates that the admission process marginalised female folks.

Table 3 – Percentage Representation of Male & Female Students in Selected Programs

Programs	Academic Session	Sex	% of enrollment	Sex	% of enrollment
B.Sc. (Ed) Statistics/ Computer Science	2009/2010-2012/2013	Male	80.96	Female	19.04
B.Sc. (Ed) Mathematics / Computer Science	2009/2010-2012/2013	Male	82.53	Female	17.47
B.Sc. (Ed) Biology	2009/2010-2012/2013	Male	49. 39	Female	50.61
B.Sc. (Ed) Mathematics/ Computer Science	2009/2010-2012/2013	Male	83.80	Female	16.20

In Biology Education, 49.39% of the total number of students who enrolled to study the program were male students, and 50.61% were female students. There has been a fair representation of female students in Biology Education for the academic years under review. In Mathematics and Statistics Education, 83.80% of students admitted into the program for the years under study were males, whereas 16.20% were female. The figures show that this field of study underrepresents female students. This imbalance results from female students' lack of interest in the careers that lead to calculation. They choose career paths that meet their personal needs.

Hypothesis:

H_0: There is a significant difference in the number of gendered enrollments in science education for the years under study.

H_1: There is no significant difference between the number of gender enrollments in science education for the years under study.

The alpha level of significance for the test is 0.05 to test the hypothesis formulated to guide the research. The critical value (i.e., the point at which we are willing to risk rejecting the null hypothesis) for the test at 0.05 alpha level of significance and 3 degrees of freedom is 7.81.

Table 4 – Summary of Gender Enrollment into Selected Disciples

Sex| Session	2009/2010	2010/2011	2011/2012	2012/2013	R – Total
Male	505(507.18)	316(304.01)	266(263.97)	132(143.85)	1219
Female	179(176.82)	94(105.99)	90(92.03)	62(50.15)	425
C – Total	684	410	356	194	1644

The decision rule is to reject the null hypothesis if the Chi-square calculated value ≥ the Chi-square tabulated value and accept otherwise. Since the computed value of Chi-square= 5.702 is less than the Chi-square tabulated value of 7.81, we lack evidence to reject the null hypothesis (H_0). Hence, we accept the null hypothesis and conclude that there is a significant difference in gender enrollment in the years under study at the University of Agriculture, Makurdi, Benue State, Nigeria.

During the research, the researcher discovered that in the four academic Sessions under study (2009/2010, 2010/2011, 2011/2012, 2012/2013), more male students were offered admission into B.Sc. (Ed) Statistics/Computer Science, B.Sc. (Ed) Mathematics/Computer Science, and B.Sc. (Ed) Mathematics/ Statistics than female students. On average, 80.96% of students admitted to study B.Sc. (Ed) Statistics/Computer Science were male, whereas 19.04% were females. In B.Sc. (Ed) Mathematics/Computer Science, 82.53% of the total students admitted into the program were male students, and 17.47% of the total admitted students in the program were females. The university admitted 75 female students to the B.Sc. (Ed) Mathematics/Statistics program, representing 16.20% of the total admissions. Additionally, it admitted 388 male students, accounting for 83.80% of the total admissions to the program. The only program that did not show any disparity in admitting students of both genders into the program was B.Sc. (Ed) Biology. Of the total number of students admitted into the program, 50.61% were females, and 49.39% were males; this agrees with most researchers' opinion that the female gender is more interested in programs related to biological science than in programs involving calculation.

In line with these findings, authors [15], in their research on gender analysis of students' enrollment in Nigerian universities between 1989 and 1997, found that a gap exists between male and female students in university enrollment, with lower female student enrollment in all aspects of the Universities in Nigeria. Conclusively, it has been established that gender imbalance exists in program allocation at the University of Agriculture, Makurdi, Nigeria.

CONCLUSIONS

Based on the analysis of gender enrollment data in the Department of Science Education at the University of Agriculture, Makurdi, Nigeria, my study offers the following conclusions:

1) Significant gender disparities exist in enrollment across various programs during the years under investigation.

2) Programs related to natural sciences demonstrated gender balance, highlighting a positive trend in inclusivity.

3) Female representation remains notably low in Statistics, Mathematics, and Computer Science programs.

My study offers the following recommendations to address these disparities:

Awareness Campaigns and STEM Marketing: Educational institutions should launch initiatives to inspire greater female participation in STEM programs where women are traditionally underrepresented. These efforts should include organising career talks in schools and universities, mentorship programs to connect female students with successful women in STEM, and showcasing role models in fields such as Statistics, Mathemat-

ics, and Computer Science. Such role models can demonstrate the potential of women to excel in these areas and help dismantle stereotypes that discourage female participation. Organisations should leverage various media to ensure these initiatives reach a broad audience. Platforms such as newspapers, magazines, radio, podcasts, television, and digital news outlets, including social media, can play a pivotal role in raising awareness about STEM programs. Social media, in particular, has proven to be an effective marketing tool capable of reaching younger, tech-savvy audiences with tailored and engaging content [16].

In addition to digital strategies, offline campaigns can also enhance outreach. Recent research highlights the efficacy of outdoor advertising, such as billboards, in running awareness campaigns and promoting causes [17,18]. These campaigns could feature powerful messages, real-life success stories, and compelling visuals encouraging girls to envision themselves in STEM careers. Community-based events, such as STEM fairs and workshops, complement these efforts by providing interactive and hands-on experiences to spark interest in science and technology. Using media channels and public engagement strategies, organisations can effectively promote gender equity in STEM education and inspire more women to pursue careers in these critical fields.

Policy Support: Universities and government institutions are critical in fostering gender equity in STEM education through targeted policy interventions. Policies such as offering scholarships, grants, and admission incentives for female students in male-dominated fields like Statistics, Mathematics, and Computer Science can significantly increase female enrollment. These financial incentives can alleviate economic barriers that disproportionately affect women and encourage them to pursue careers in STEM. Additionally, gender quotas or affirmative action programs could ensure fair representation of women in these programs. Policymakers should also prioritise long-term strategies, such as funding mentorship and leadership programs designed specifically for young women in STEM, to create pathways for success. By establishing and rigorously implementing these policies, universities and governments can create a supportive environment that empowers women and actively works to dismantle systemic inequalities.

Curriculum Redesign: Redesigning STEM curricula to incorporate gender-sensitive teaching methods and content is essential for creating an inclusive and equitable educational environment. Traditional teaching methods often unintentionally reinforce stereotypes about women's perceived capabilities in STEM fields, discouraging female participation. By integrating case studies, examples, and historical contributions by women in STEM into the curriculum, educators can challenge these stereotypes and inspire female students to see themselves as capable contributors to the field. Additionally, hands-on, collaborative learning approaches can make STEM subjects more engaging and reduce the intimidation factor that often deters women. Teacher training programs should also emphasise the importance of inclusivity, equipping educators with the skills to recognise and address unconscious biases. A reimagined, gender-sensitive curriculum can help build confidence in female students and foster a sense of belonging in male-dominated programs.

Stakeholder Collaboration: Collaboration between universities, non-governmental organisations (NGOs), industries, and alumni networks can create a robust support system to encourage female participation in STEM. NGOs focused on education and gender equity can provide resources and advocacy for initiatives that promote women in STEM. Industries can contribute by offering internships, apprenticeships, and mentorship programs tailored to female students, exposing them to real-world applications of their studies and helping them build confidence in their abilities. Alumni, especially women who have succeeded in STEM careers, can be role models and mentors, inspiring the next generation of female students. Additionally, joint initiatives between these stakeholders can create a pipeline from education to employment, ensuring that female STEM graduates are not only enrolled but also retained and supported in their professional journeys. Such collaborations can amplify efforts to close the gender gap and create sustainable change in STEM education and career opportunities.

Addressing gender imbalance in STEM programs is critical for fostering diversity and innovation. These recommendations provide actionable steps toward achieving gender equity in the academic and professional landscapes of Science, Technology, Engineering, and Mathematics.

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