


Chapter 26

Enrolment and Completion Rate amongst Females in STEM Postgraduate Programmes in Universities in South West Nigeria

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Abstract

In Nigeria, undergraduate and postgraduate female students are more fully represented in disciplines such as Arts, Education, Management, and so on than in Science, Technology, Engineering and Mathematics (STEM) courses. The gender disparity in the Science and Technology fields is growing, which is worrying, considering 90% of the jobs in the next 10 years will require technological knowledge and skills in Nigeria. Several researches have focused on encouraging enrolment of females into STEM undergraduate courses, with fewer studies on females' interest into STEM postgraduate programmes in Nigerian universities. Thus, this study investigated the enrolment and completion rate amongst female students in STEM postgraduate programmes in South West Nigeria. The study was guided by the Role Congruity Theory, while the mixed methods design was adopted. The convenience sampling technique was used to select female postgraduate students in the STEM faculties from two federal and three state universities in Lagos, Ogun and Oyo states respectively. 69 Google Forms questionnaires were retrieved and 14 in-depth interviews were conducted as well with selected female postgraduate students. Data were analysed by using percentages, content analysis, and so on. Findings revealed that the enrolment of females was more in Master's degrees than in the Ph.D. programmes, while the completion rate took longer for some females. Challenges encountered were linked to home front, funds, sponsorship, mentoring, and so on. Thus, the study recommends that the provision of full sponsorship, day care centres, scholarships, mentoring

and so on should be introduced by the government, as this will enable and motivate females' enrolment into STEM postgraduate programmes in Nigerian universities.

Keywords: Females, Postgraduate Programmes, Postgraduate Students, STEM, Universities

Introduction

In Nigeria and other countries in Africa, both undergraduate and postgraduate females appear to be fully represented in university enrolment, especially in disciplines such as Arts, Education, Management, and so on but with fewer undergraduate students enrolled into the STEM (Sciences, Technology, Engineering and Mathematics) courses of study. This can pose a big hindrance in opening doors to opportunities and development for women in STEM where Masters and Ph.D. degrees are requirements for employment. Thus, there is a need for a shift in both the mindset and perception towards the enrolment of females into STEM postgraduate courses in Nigerian universities (Okeke, 2019). STEM includes courses in the Engineering and Technology, Mathematics and Computer and Information Sciences, Agricultural Sciences, Physical Sciences and Biological Sciences. Disciplines in the Social and Behavioural Sciences and health workers like Doctors and Nurses are not included or categorised as part of the STEM courses (Hill et al., 2010).

Gender disparity in the Science and Technology fields is growing, which is worrying considering the fact that 90% of the jobs in the next 10 years in Nigeria will require technology knowledge and skills. Thus, nations have come to realise and agree that STEM happens to be the major purpose when determining their economic growth and development with the global technological changes in the labour market. However, the gender gap in STEM still exists in enrolment into tertiary institutions in Nigeria and may have negative implications on enabling development in the technological aspect of the economy (Okorafor et al., 2015). The low enrolment amongst female students into courses in STEM have been linked to certain factors amongst which is the traditional perspective that men are more suitable than women. Other causes of challenges amongst female students have been linked to the lack of confidence and interest in STEM courses from even primary education, poor funding, no mentoring, lack of support from home and the institution.

Globally, some females in STEM professions have emerged over the years and they have significantly contributed to the social and economic development of their home countries. Amongst notable females who changed the world through STEM are: the NASA space scientist known as Katherine

Johnson; the Countess of Lovelace: the famous mathematician, Augusta Ada King; Radia Perlman – Internet pioneer; Joan Clarke, code breaker and cryptanalyst; Susan Kare, iconographer; Rear Admiral Grace Hopper, inventor and computer scientist; Florence Nightingale, social reformer and statistician; Adriana Ocampo, planetary geologist; Irene Au, human computer interaction designer; Roberta Bondar, astronaut neurologist; Ginni Rometty, CEO of IBM; Barbara McClintock, geneticist, and so on (International Women's Day, 2016).

In a report by the World Bank (2021) on the advancement of females' participation in STEM, the findings revealed that globally, for every 100 men enrolled in universities, there are 115 women enrolled. STEM courses in the universities had fewer females than men enrolled; Engineering courses had only 7% of females, Manufacturing or Construction had 22% females, Natural Sciences had 5%, Mathematics and Statistics had 6%, and Information and Communication Technologies had only 3% and 8% females enrolled respectively. The report further stated that there is a need for a much more detailed data and research outside the US and Europe contexts, that use rigorous methodologies as well as large and more diverse samples (World Bank, 2021).

According to the National Science Foundation (NSF, 2010), an estimation of about five million individuals have direct work in the Science, Technology, Engineering and Mathematics jobs with just over 4% of the various occupations in the entire world. This minority of workers are amongst the critical workforce that are crucial to economic innovation and productivity. In addition, employees working in the fields of STEM are well-paid and enjoy a much-secured job in the labour market. The United States Department of Labour reports that the workforce projection for 2018 to 2028 shows that training will be required in a significant scientific or a mathematical knowledge in at least a bachelor's degree in the 10 fastest growing occupations (WorkForce GPS, 2019). Several of the Science and Engineering jobs have been predicted to grow faster than the average rate of growth in other occupations. However, women currently hold only one of a quarter or lesser compared to men in Engineering and computer-related types of jobs (Lacey & Wright, 2009; NSF, 2010).

According to Espinosa (2011), it is pertinent to know that supporting university undergraduate achievements in courses in STEM happens to be paramount in ensuring a sustainable scientific and technological advancement. Although several researches and policies have focused on encouraging enrolment of females into STEM undergraduate programmes and at secondary school level, less studies have shown statistics on women's interests in proceeding into STEM Master's and Ph.D. programmes in Nigerian

universities. Thus, this study investigated the enrolment and completion rate amongst female students in STEM postgraduate programmes in South West Nigeria. In addition, the challenges encountered by the postgraduate female students as well as possible solutions were also investigated in order to enable women's full participation in educational and career opportunities in STEM fields that will enhance the national development of the country.

Statement of the problem

Girls' and women's participation in STEM courses and professions have brought about concerns amongst the government, institutions of learning and other stakeholders in Nigeria. Despite the creation and implementation of several policies and interventions to increase the enrolment of females into these STEM courses in Nigeria, there are still shortages in the full participation of women in the world of work. These interventions include the CapED Programmes 18 initiated by UNESCO (2019) in order to support fragile and low-income countries like Nigeria. This is to design and implement education reforms that can enable the achievement of the national development priorities and goal 4 of the Sustainable Development Goals (SDGs) (UN, 2015) as well as enabling the participation and inclusion of girls into STEM (UNICEF & ITU, 2020). Some NGOs are not left out in the drive to enhance girls' participation into STEM subjects in the country. They include High-Tech Women (High-Tech Women, 2024), which focuses on empowering young girls, women and youth through ICT (information and communication technology) for research, entrepreneurial and wealth creation. The Pearls Africa Foundation, championed by Abisoye Ajayi-Akinfolarin, has also encouraged young girls to participate in coding which equips and enables functional IT (information technology) skills.

Women are less represented in STEM jobs, especially where skills and knowledge derived from postgraduate studies are requirements. In Nigeria, only 28% of females are involved in the jobs of STEM, compared to men. The gender gaps appear to be high in the future of these jobs which are highly paid. Examples of these jobs include Computer Science and Engineering. Thus, giving women equal chances to be involved in careers in STEM will definitely help in narrowing the gender gap, enable and enhance women's economic security that will ensure a talented workforce and the prevention of biases in the field of STEM. Thus, this study examined the enrolment and completion rate amongst females in STEM postgraduate programmes, and the challenges that they encounter in universities in the South West geopolitical zone in Nigeria.

Research objectives

The broad objective of this study is to determine the enrolment and completion rate of female students in postgraduate programmes in universities in South Western Nigeria. The specific objectives are to:

1. determine female students' enrolment into STEM faculties in universities in South West Nigeria
2. examine the completion rate of female students in postgraduate STEM faculties in South West Nigeria
3. examine the challenges associated with postgraduate female students in STEM faculties in South West Nigeria, and
4. proffer policy recommendations that will enhance the enrolment of female students into postgraduate courses in South West Nigeria.

The study is limited to all the female postgraduate students in the Science, Technology, Engineering and Mathematics departments in the universities in South Western Nigeria, in order to enable and enhance their participation in to STEM educational and career prospects.

Literature review

The level of women's participation in Science, Technology, Engineering and Mathematics (STEM).

Over the years, the role of women has always been critical within the Science, Technology, Engineering and Mathematics fields. However, these contributions have been overlooked and have even been forgotten. The campaign for the inclusion of women into STEM courses has been continuing for decades because of the importance on the economic development of any nation. The campaign for equal access to education applies to the STEM subjects and programmes, most especially for the STEM postgraduate studies. To date, there is a Science gender gap. According to the UK Education Hub (2021), less than 30% of women are amongst the world researchers and this applies to every country of the world.

According to AAUW Action Fund online report (2022), girls and women are systematically exempted from Science and Mathematics even from the elementary stage of schooling to the highest level of education. This has limited women's access, preparation to opportunities in the STEM fields as adults. As a result of this only 21% of women make up the workforce of STEM jobs. The gender gaps are particularly high in some of the fastest-growing and highest-paid jobs of the future, like Computer Science and Engineering.

Theoretical framework

Role Congruity Theory (Eagly & Karau, 2002)

The study was guided by the Role Congruity Theory by Eagly and Karau in 2002, which states that the prejudice aimed at women's involvement and participation into specific occupations, responsibilities and roles tends to happen because of the inconsistencies that exist amongst the characteristics that are associated with the female gender stereotype. These stereotypes are also associated with roles and positions in typical leadership. Furthermore, the Role Congruity Theory proposes that a particular group tends to be positively evaluated after its characteristics are recognised and appreciated when it aligns with a groups' typical social roles and functions (Eagly & Diekmann, 2005). Conversely, the stereotype fit hypothesis that suggests that group members will experience discrimination in different social roles or positions to the extent that their group stereotypically does not have characteristics associated with success in the position.

The Role Congruity Theory is related to this study because STEM courses are believed to be for the male folk rather than the females. This stereotyping has limited females' interest and participation in STEM courses even from early education. Young female students tend to have a fear for Mathematics and this phobia lingers into higher education studies such as STEM courses at undergraduate and postgraduate levels.

Methodology

The mixed methods design was implemented for the study. The design enabled the combination of both the qualitative and quantitative approaches for comprehensive collection of data. The study population comprised of all females in STEM postgraduate courses in universities in the South West region, Nigeria. Out of the six states in the South Western region, three states were randomly selected, where two federal (University of Ibadan and Federal University of Agriculture) and three state universities (Lagos State University, Olabisi Onabanjo University, Ladoke Akintola University of Technology) were selected from South West region, Nigeria. Also, the purposive sampling technique was used to select females in the STEM postgraduate programmes from the selected universities. The instrument used for data collection was an in-depth interview guide and a 32-item online Google Forms questionnaire designed to capture information on their demographic information, length of study and the challenges encountered by the female postgraduate students in the STEM programmes. The instrument was administered by the Deans, Provosts and Faculty officers of the Postgraduates Colleges

in the selected universities through the generated online link from the Google Forms questionnaire via WhatsApp. The instrument comprised closed-ended questions in a four-point Likert scale of 'Strongly Disagree', 'Disagree', 'Agree' and 'Strongly Agree' with weighed values of 1, 2, 3 and 4 respectively. The instrument was given to experts who carried out face validity. 72 responses were retrieved with only 69 valid responses, and this was adequate for the study. Furthermore, 14 in-depth interviews were conducted with STEM postgraduate female students randomly selected from the selected universities, in order to obtain detailed information on the enrolment and completion rate of STEM female postgraduate students as well as the encountered challenges. The data were analysed by using descriptive statistics and content analysis.

Results and discussion

Demographics

Table 28: Distribution of female postgraduate students' marital status in STEM faculties in South Western Nigeria.

Marital Status				
	Frequency	Percentage	Valid percentage	Cumulative percentage
Divorced	1	1.4	1.4	1.4
Married	38	55.1	55.1	56.5
Separated	1	1.4	1.4	58.0
Single	29	42.0	42.0	100
Total	69	100	100	

Source: Field work 2023

The findings according to Table 28 also revealed that the number of married female postgraduate students (55.1%) enrolled in the STEM postgraduate programmes in the universities in South Western region, Nigeria was more than the single female postgraduate students (42%).

Table 29 shows that the majority of the female postgraduate students were between 20 years and 49 years old. In addition, the findings show that women over 50 years of age were also enrolled in the STEM postgraduate programmes (4.3%) but at a very minimal representation.

Table 29: Distribution of the Age of Female Postgraduate Students in STEM Faculties in Universities in South Western Region, Nigeria

Age				
	Frequency	Percentage	Valid percentage	Cumulative percentage
20 - 29	26	37.7	37.7	37.7
30 - 39	22	31.9	31.9	69.6
40 - 49	18	26.1	26.1	95.7
50 - 59	3	4.3	4.3	100
Total	69	100	100	

Source: Field work 2023

Presentation of results

Objective 1: Determine female students' enrolment into STEM faculties in universities in the South Western geo-political zone in Nigeria

Table 30: Distribution of the Number of Female Postgraduate Students in the STEM Faculties in South Western region, Nigeria.

Faculty				
	Frequency	Percentage	Valid percentage	Cumulative percentage
Engineering	3	4.3	4.3	4.3
Mathematics	4	5.8	5.8	10.1
Science	49	71.0	71.0	81.1
Technology	13	18.8	18.8	100
Total	69	100	100	

Source: Field work 2023

Table 30. The findings from the study reveal that the female postgraduate students were mostly enrolled in the Faculties of Science at 71%, while the department of Mathematics had the least number of enrolled female postgraduate students, at 5.8%.

Table 31: Distribution of Females in the Postgraduate programmes in the STEM Faculties in Universities in South Western Region, Nigeria.

Postgraduate Programme				
	Frequency	Percentage	Valid percentage	Cumulative percentage
M.Phil/ Ph.D.	5	7.2	7.2	7.2
Master's Degree	43	62.3	62.3	69.5
Ph. D.	21	30.4	30.4	100
Total	69	100	100	

Source: Field work 2023

Table 31 reveals that the female students enrolled more in the Master's degree STEM programmes (62.3%), while less than half of the Master's degree students were enrolled in the Ph.D. programmes. These findings also show that although female students are now enrolled into Ph.D. STEM programmes, the disparity between the female and male numbers is still significant.

Table 32: Distribution of Female Postgraduate Students' Enrolment into STEM programmes by Year

Postgraduate Programme				
Year of entry	Master's degree	M.Phil/Ph.D.	Ph.D.	Total
2001/2002	1	0	0	1
2014	0	0	1	1
2016/2017	0	1	1	2
2017/2018	1	1	4	6
2018/2019	1	1	2	4
2019/2020	3	0	5	8
2020/2021	7	2	3	12
2021	12	0	0	12
2021/2022	7	0	2	9
2022	11	0	2	13
2023	1	0	0	1
Total	44	5	20	69

Source: Field work 2023

Findings on Table 32 show that very few female students were enrolled into STEM Master’s and none for Ph.D. degree programmes in earlier years – 2001/2002, but there was an increase in female’s enrolment in 2021 especially in the Master’s degree programmes. There was an increased women’s enrolment into Ph.D. programmes and the highest number of women who enrolled in Ph.D. programmes was in the 2019/2020 academic session. The findings also reveal that there are female postgraduate students who have spent longer years on acquiring their Master’s degree in the STEM faculty. The findings show that female students who were enrolled in 2016/2017 to 2018/2019 academic sessions had stayed longer than the usual two years in acquiring their Master’s degree.

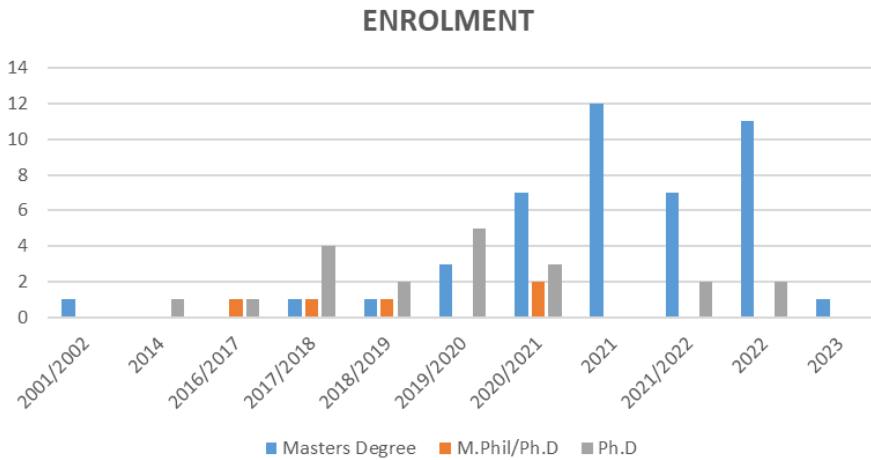


Figure 21: Enrolment by Year of Female Postgraduate Students in STEM Faculties in Universities in South West Region, Nigeria. Source: Field work 2023

Objective 2: Examine the completion rate of female students in postgraduate STEM faculties in South West geo-political zones in Nigeria

I have spent more years in the programme than I am supposed to.

	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	15	21.7	21.7	21.7
Disagree	20	29.0	29.0	50.7
Strongly Agree	19	27.5	27.5	78.3
Strongly Disagree	15	21.7	21.7	100.0
Total	69	100.0	100.0	

Figure 22: Completion rate of female students in postgraduate STEM faculties. Source: Field work 2023

Findings reveal that 21.7% and 27.5% of the respondents indicated 'Agree' and 'Strongly Agree' to have spent more years on STEM Postgraduate programmes than they were supposed to.

Objective 3: Examine the Challenges Associated with Postgraduate Female Students in STEM Faculties in Universities in South West Region, Nigeria,

Table 33: Female Postgraduate Students' Comfort with Course of Study in STEM Programmes

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	36	52.2	52.2	52.2
Disagree	4	5.8	5.8	58.0
Strongly Agree	26	37.7	37.7	95.7
Strongly Disagree	3	4.3	4.3	100
Total	69	100	100	

Source: Field work 2023

Table 34: The course workload in my department is just convenient for me

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	43	62.3	62.3	62.3
Disagree	13	18.8	18.8	81.1
Strongly Agree	12	17.4	17.4	98.6
Strongly Disagree	1	1.4	1.43	100
Total	69	100	100	

Source: Field work 2023

Table 35: I assimilate and have full understanding of my course of study

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	42	60.9	60.9	60.9
Disagree	10	14.5	14.5	75.4
Strongly Agree	16	23.2	23.2	98.6
Strongly Disagree	1	1.4	1.4	100
Total	69	100	100	

Source: Field work 2023

Table 36: I am able to attend my lectures regularly

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	39	56.5	56.5	56.5
Disagree	11	15.9	15.9	72.4
Strongly Agree	18	26.1	26.1	98.5
Strongly Disagree	1	1.4	1.4	100
Total	69	100	100	

Source: Field work 2023

Table 37: My lecturers are very detailed in delivering instructional studies

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	42	60.9	60.9	60.9
Disagree	10	14.5	14.5	75.4
Strongly Agree	16	23.2	23.2	98.6
Strongly Disagree	1	1.4	1.4	100
Total	69	100	100	

Source: Field work 2023

Table 38: I engage in considerable number of practical activities as expected

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	39	56.5	56.5	56.5
Disagree	16	23.2	23.2	79.7
Strongly Agree	10	14.5	14.5	94.2
Strongly Disagree	4	5.8	5.8	100
Total	69	100	100	

Source: Field work 2023

Table 39: My institution has adequate laboratory and resources to enable my detailed knowledge and skill development of my discipline (STEM)

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	31	44.9	44.9	44.9
Disagree	22	31.9	31.9	76.8
Strongly Agree	5	7.2	7.2	84.1
Strongly Disagree	11	15.9	15.9	100
Total	69	100	100	

Source: Field work 2023

Table 40: My career aspiration aligns with my current course of study

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	46	66.7	66.7	66.7
Disagree	2	2.9	2.9	69.6
Strongly Agree	20	29.0	29.0	98.6
Strongly Disagree	1	1.4	1.4	100
Total	69	100	100	

Source: Field work 2023

Table 41: I receive a form of scholarship or support from my university as a female STEM postgraduate student

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	3	4.3	4.3	4.3
Disagree	24	34.8	34.8	39.1
Strongly Agree	4	5.8	5.8	44.9
Strongly Disagree	38	55.1	55.1	100
Total	69	100	100	

Source: Field work 2023

Table 42: I get enough encouragement from my university, faculty, department as a female STEM postgraduate student

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	34	49.3	49.3	49.3
Disagree	20	29.0	29.0	78.3
Strongly Agree	5	7.2	7.2	85.5
Strongly Disagree	10	14.5	14.5	100
Total	69	100	100	

Source: Field work 2023

Table 43: I am able to foot the fees of my postgraduate studies

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	35	50.7	50.7	50.7
Disagree	20	29.0	29.0	79.7
Strongly Agree	10	14.5	14.5	94.2
Strongly Disagree	4	5.8	5.8	100
Total	69	100	100	

Source: Field work 2023

Table 44: I am not able to afford other expenses (transportation, reading materials, getting materials for hand on assignments and projects)

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	28	40.6	40.6	40.6
Disagree	27	39.1	39.1	79.7
Strongly Agree	6	8.7	8.7	88.4
Strongly Disagree	8	11.6	11.6	100
Total	69	100	100	

Source: Field work 2023

Table 45: I don't get good grades in my course of study

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	2	2.9	2.9	2.9
Disagree	38	55.1	55.1	58.0
Strongly Agree	0	0	0	58.0
Strongly Disagree	29	42.0	42.0	100
Total	69	100	100	

Source: Field work 2023

Table 46: I have spent more years in the programme than I am supposed to

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	15	21.7	21.7	21.7
Disagree	20	29.0	29.0	50.7
Strongly Agree	19	27.5	27.5	78.3
Strongly Disagree	15	21.7	21.7	100
Total	69	100	100	

Source: Field work 2023

Table 47: I receive no support from my family members

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	4	5.8	5.8	5.8
Disagree	32	46.4	46.4	52.2
Strongly Agree	5	7.2	7.2	59.4
Strongly Disagree	28	40.6	40.6	100
Total	69	100	100	

Source: Field work 2023

Table 48: The workload from home affects my academic performance

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	19	27.5	27.5	27.5
Disagree	25	36.2	36.2	63.8
Strongly Agree	9	13.0	13.0	76.8
Strongly Disagree	16	23.2	23.2	100
Total	69	100	100	

Source: Field work 2023

Table 49: There is provision of baby day care services while I receive lecturers

	Frequency	Percentage	Valid percentage	Cumulative percentage
Agree	15	21.7	21.7	21.7
Disagree	26	37.7	37.7	59.4
Strongly Agree	4	5.8	5.8	65.2
Strongly Disagree	24	34.8	34.8	100
Total	69	100	100	

Source: Field work 2023

Responses from the in-depth interviews conducted revealed the challenges encountered by the female postgraduate students in STEM programmes in universities in South West region, Nigeria. As stated, the challenges mentioned by the female postgraduate students were:

“As a married female student and combining the responsibilities of a wife, mother, student and working class is not easy but my family supports me and even financially”.

Most of the female postgraduate students mentioned this as a challenge that hindered their full participation in their course work. Other challenges mentioned were: lack of communication and feedback from their lecturers, absence of mentorship, no Internet facilities, shortages of resource materials, and so on.

“Communication and feedback about what you need to know or do are not always shared to students”

“Left a university after 3 years of no progress because I was told I’m not their Alma mater. Little/No agreement with students”

“No free access to Internet facilities in the department. They should provide Classroom for only PG students, it will help to create room for interactions. Our lecturers have too much workloads thereby making it difficult for them to spend quality time with the PG students”

“Not getting information of conferences or meetings to attend in order to meet and network with like minds”.

“There are no adequate equipment or facilities that could help speed up research work or make the learning environment conducive. You have to get all you need with your money, outsource some experiments. No consideration given to female who are married or about to have children”.

“No toilet facilities Power failure that affects practicals”

“The workload from work and the Ph.D. program coupled with marital duties is overwhelming. The workload is much, Over spent years of studies”.

“There were no recent or current instructional materials at our disposal during lectures. Too much theory less practical. Uncooperative attitudes of the supervisors, mental and sexual threats from male supervisors”

Discussion of findings

The findings from this study reveal that the enrolment of females in postgraduate STEM courses in universities in the South West geo-political zones of Nigeria appear to be at a minimal level compared to even at secondary and undergraduates' level. The distributions of students' enrolment show the female postgraduate students are enrolled more in the Sciences but with the least of them enrolled in the Mathematics department. This finding corroborates with the study conducted by Canning et al. (2019). Also, the findings show that the females in STEM postgraduate courses in Nigerian universities tend to spend longer years in their field of study. This finding can be said to be associated with the findings that also show that a larger percentage of the females are married. Thus, combining marriage and postgraduate studies was a major challenge that distracted female STEM postgraduate students. In addition, the postgraduate females in STEM programmes encounter other challenges, which included poor funding, support from the universities, lack of mentoring, lack of family support and no baby care arrangement for the nursing mothers for some of the females in the postgraduate STEM courses in the universities. On the other hand, the findings from the study reveals that the female postgraduate students happen to be comfortable with their course of study, have good grades in their academic performance, they attend lectures regularly and have a cognitive understanding of the STEM courses.

In summary, the findings from this study reveal that achieving the considerable number of women participations in STEM jobs in the future might not be realisable in Nigeria if the necessary intervention is not performed soon. Thus, there is a need for the federal and state government, and university institutions to take up the necessary measures to enable the participation and development of females' skill and knowledge in STEM disciplines especially at postgraduate levels of university education.

Policy recommendations

As a result of the findings deduced from this study, although more female students endeavour to enrol into STEM programmes at Master's and Ph.D. levels compared to earlier years, there is still the need to encourage females' enrolment and timely completion in these STEM postgraduate programmes. This will enable female participation in STEM professions that will facilitate national development in Nigeria. Thus, this study recommends that:

The Federal and State government, universities, other higher institutions and other stakeholders of STEM should note that: -

- There is the urgent need to promote STEM awareness and interest amongst female undergraduate and postgraduate students in STEM courses by creating supportive and inclusive learning environments, financial support and scholarships, capacity-building and skills development, collaboration and partnerships.
- There should be a high level of encouragement from secondary school stage through sensitive programmes like career talk especially for the females.
- There should be a programme that would encourage females into STEM postgraduate courses such as orientation programmes, innovation programmes, successful females in STEM professions to share their own experience and how they made it.
- A deliberate form of mentorship programme at every level of study. Mentors can be situated outside the university of the mentees, with an entrenched means of tracking improvement.
- Fund / grant / scholarship. If students are sure that they will graduate within reasonable years, it will also encourage many to enrol.
- Employment and career opportunities after females enrol into STEM programmes, in order to be able to obtain a lecturing job. If female postgraduate students have chances of being employed, many will want to commit themselves to the study.
- Provision of baby day care services while female postgraduate students in STEM courses receive lectures because it would be very helpful for nursing mothers who are students.
- Further, a more practical curriculum should be used instead of the theoretical coursework that is being used currently by universities; at least it will tailor a better futuristic endeavour.
- Incorporation of online classes and assessments as well as the provision of Internet facilities to STEM departments.
- Lecturers and supervisors should be approachable and make efforts to ensure their students graduate at due time. Students should be allowed

to make their challenges known without being punished for expressing themselves.

- More skilful administration and avoidance of delaying students from graduation, especially female students, as such delays are usually psychologically traumatic.

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