

Gender Differences College of Education Students' Enrolment Pattern in and Attitude towards Science, Technology and Mathematics Education

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Abstract

This study was carried out to investigate gender as a correlate of students' enrolment pattern in and attitude to science, mathematics and technology education at colleges of education southwestern Nigeria. The study employed the correlational design. A total of 36,514 college of education students offering course combinations in Physics, Chemistry, Biology, mathematics and Technology Education. This comprised 16,438 male and 20,076 female students. The instruments were Students' Enrolment Checklist ($r=0.72$) and Science, Technology and Mathematics Education Attitude Inventory ($r=0.7$). Data were analysed using frequency counts, percentages and statistics t -test. The result revealed that more female students enrolled for courses in the sciences than in mathematics and technology education than in subject combinations that relate to physics and mathematics. The study also established that technology education enjoyed higher male students' enrolment than for female students. The study recommended that all stakeholders in Nigeria Education should provide conducive teaching and learning environment that will stimulate students' interest in STME especially at the colleges of education, while classroom environment must be devoid of any forms of gender bias.

Keywords: Gender, pattern of enrolment, attitude, Science, technology and mathematics education

Introduction

Education in Nigeria and indeed the world over is acquired at three main levels which include the basic (primary), secondary and tertiary levels of education. According to FRN (2013), tertiary education is a kind of education given after post basic education in institution such as university and inter-university centres among which are the colleges of education, polytechnics, mono - technics and other specialized institutions such as colleges of agriculture, school of health technology among others. The tertiary institutions have the duties of ensuring the quality of students' intake, quality of teaching and learning as well as research and development. The extent to which the tertiary institutions in Nigeria have complied in terms of achieving these quality objectives is a matter that calls for investigation.

Section 5, subsection 92(a) and (b) recognise the vital role of quality teacher education to promote quality education at all levels. The minimum qualification for entry into the teaching profession in Nigeria, as stipulated in the policy should be the Nigeria certificate in education (NCE). By implication, the colleges of education are saddled with the responsibility of producing teachers that would teach at the basic level of Nigeria education system. To a large extent, the quality of teachers determines the quality students or output of the system. At the colleges of education level, students are admitted into different courses of study including, science, technology and mathematics related fields. In line with section 5 subsection 91 (1) not less than 70% of

the admission quota should be allocated to sciences and science-oriented courses. Earlier investigation on the level of compliance with the policy statement revealed that only a few colleges did comply (Raimi, Farayola and Sodamade 2019, Mofikoya 2014), why these colleges of education have not complied+ many years after the formulation of the policy is still a matter for further investigation.

Specifically, colleges of education technical are a part of tertiary institutions saddled with the responsibilities of producing teachers for technology education they are to provide courses of instruction and training in engineering, and other technologies, applied sciences business and management studies as stipulated by section 5, subsection 101 and 108 of the policy which emphasises on strict compliance with the ratio of students in science and technology based courses in these specialised instructions. According to the section not less than 70% of student, enrolment shall be allocated to technology related courses / career.

Furthermore, the emphasis placed on what the ratio of enrolment pattern of students in science and technology based courses should be also attest to the importance of these fields of human endeavour, and further strengthen the link between the two broad fields.

In order to achieve sound science and technology education, the role of mathematics can not be underestimated. Studies in science education have lent credence to this assertion, For instance, Adesoji 2002, Raimi 2002 found in separate studies that mathematical experience would be interesting in developing individual's abilities to understand social

institution and in equipping one to solve problems effectively. From here, it is evident that, the trio of science, technology and mathematics education are inseparable as there exist strong relationship among the fields. Students who specialise or pursue careers in these or related fields are expected to impact positively on future generations and contribute to the technological advancement of the nation. As a result, a study that focuses on the students' enrolment in the field of science, technology and mathematics education is desirous especially at the college of education level, where would-be teachers of the subjects are trained. Experience and extant literature have consistently shown that in spite of the policy statements on the ratio of admission into science of technology based courses at the tertiary level of education, in Nigeria, the enrolment patterns has remained relatively unchanged. This is because majority of students seeking admission into various tertiary institutions still opt for courses in fields other than science and technology related careers (Mofikoya, 2014, Raimi et al 2019). Reports especially those of the Chief examiners in WASSCE and NECO examinations have also revealed poor performance on the part of the few that enrolled in the sciences.

The report shows clearly that students' achievement in chemistry has been below average over a period of 10 years between 2001 and 2010 except in 2003 and 2005 where students' performance appear to be marginally above average: Evidence from relevant studies also affirm that the results are not in anyway different for other basic sciences. It is even worse for mathematics as reported by Mofikoya (2014,) Raimi, Farayola and Sodamade (2019), Adeoye (2016). A number of reasons have been advanced for the observed underachievement by students in the basic sciences and its attendant effects on enrolment in science and technology related careers at the higher level of education especially in Nigeria. Although the national policy on education did not stipulate what students enrolment in STME should be on the basis of gender, a study that dwelt or provides empirical information on students' participation in Science, Technology, and Mathematics Education (STME) will also be fascinating and worthwhile especially at the College of education level.

The relationship between sex, enrolment and performance at cognitive, psychomotor and affective domains of learning have equally been widely studied. Prominent among the scholars and researchers who have worked in this area especially

in Nigeria are Onocha and Okpala 2005 Adeoye 2016, Raimi 2002, 2005, and Ezekiel 2016). Findings from all these studies shown conflicting results on the effect of gender on achievement.. Some of these studies revealed gender superiority in performance in favour of boys at certain levels of learning, some reveal superiority of performance in favour of girls while others show no significant difference between the two sexes in term of their performance in Science and mathematics. While majority of these studies focussed on the relationship between students' gender and achievement, only a few dwelt on the impact of gender on enrolment and attitude towards SIME. This study intends to full this sup. Also the few studies that are available in this area were carried out at the basic/secondary school levels of education. The preteens study investigated the extent to which students' gender will predict their enrolment in STME and their attitude towards the fields: as the investigation was carried out at the college of education level (which is a major ladder in Nigeria education system) especially in the southwest, Nigeria.

Statement of the problem

The main focus of this study was to find out gender differences in students' pattern of enrolment in and attitude to Science, Technology and Mathematics Education in colleges of education in southwestern Nigeria.

Significance of the study

The present study will provide further empirical information on gender differences in students' pattern of enrolment in and attitude to Science, Technology and Mathematics Education in colleges of education in southwestern Nigeria. The findings of this study will not only be useful to education policy makers, it will also serve as a good reference point for further researches in science, technology and mathematics education.

Research Questions

1. What is gender distribution of enrolment in science, technology and mathematics education in college of education in Nigeria?
2. Is there any gender difference in enrolment in science, technology and mathematics education in college of education in Nigeria?

Methodology

The study employed the survey research design. NCE undergraduate students in all the colleges of education

within the southwest of Nigeria constitute the population from which the sample for the study were drawn. Sample for the study consists of 36,514 students who enrolled for careers in science, technology and mathematics education related courses/fields in all the thirty four (34) colleges of education in the southwest zone, Nigeria. This number, comprised 15,048 male and 21,466 female students. The instruments used were Student Enrolment Checklist ($r=0.72$) and Science, Technology and Mathematics Education Attitude Inventory ($r=0.73$). A letter of introduction were submitted to the registrars/Academic Affairs officers

of the various institutions involved in the study Twelve research assistants were appointed and trained. The researchers served as monitors who ensured strict adherence to the tenets of the research by the research assistants. Data were analysed using frequency count, simple percentage and t-test.

Results

Research Question 1: Does students' gender impact on the pattern of enrolment in science technology and mathematics evocation in colleges of education in Nigeria?

Table 4.: College Of Education Students' Pattern Of Enrolment In Science, Mathematics And Technology Education Based On Gender

S/N	SUBJECT AREA	TOTAL ENROLMENT	MALE		FEMALE	
			N	%	N	%
1.	Biology	7354	2134	5.89	5205	14.25
2.	Chemistry	6809	2572	7.04	4237	11.60
3.	Computer Science	6856	3439	9.42	3417	9.36
4.	Physics	3993	2422	6.63	1571	4.30
5.	Integrated Science	3256	1017	2.78	2239	6.13
6.	Mathematics	6506	3752	10.28	2754	7.54
7.	Health Education	134	34	0.01	100	0.03
8.	Technical Education	1606	1053	2.88	553	1.51
	TOTAL	36514	16438	44.93	20076	55.07

	M	F
Science	- 6912 (18.92)	17184 (40.06)
Technical Education	- 1053 (2.88)	553 (1.51)
Mathematics	- 3752 (10.28)	2754 (7.54)

Result of data analysis as shown in table 1 gave some striking revelations about students' enrolment in the subject areas under investigation. To drive home this point, for instance, table 4.4 shows that, more females enrolled in science mathematics and technology related courses. In this connection, out of thirty- six thousand, five hundred and fourteen (36,514) students that enrolled for science, mathematics and technology related courses, only sixteen thousand four hundred and thirty-eight (16,438) were males, while twenty thousand and seventy-six (20,076) or 55.07% are female. This indicates that more female students enrolled to pursue careers in the various fields of science and technology related courses than their male counterparts in college of education in the southwest, Nigeria. Further detailed examination of the results of analysis revealed that majority of the female students have preference for Biology related subject combinations at NCE level. Out of seven thousand, three hundred and fifty-four (7,354) that enrolled for Biology, only two thousand, one hundred forty-nine (2,149) (5.89%) are males while five thousand, two hundred and five (5,205) (14.25%) are females (Highest in all the science and applied science courses considered in the present study).

A closer look at the analysis in table 1 also revealed that higher proportion of female students enrolled in all the subject areas considered in the study. The only exception to this observation (where more males opted for the subjects than their female counterparts) are computer science [male 3,439 (9.42%), females 34, 177 (4.36%)], physics [male 2,422 (6.63%), female 1,571 (4.30%)], mathematics [male 3,752 (10.28%), female 2,754 (7.54%)] and technical education [male 1053 (2.88%), female 553 (1.51%)].

Considering the total enrolment in science generally as an entity. It is revealed that out of 36, 514 students that enrolled in all the three major areas under investigation, a total of 28,402 representing 77.78% are in the core and applied science courses. Of this number, nine thousand seven hundred and three 9,703 (26.57%) are males while sixteen thousand, seven hundred and sixty-nine 16,769 (45.92%) are females. Similarly, a sum of six thousand, five hundred and six 6,506 (17.81%) students enrolled in mathematics out of who, three thousand, seven hundred and fifty-two 3,752 (10.28%) are males while two thousand, seven hundred and fifty-four 2,754 (7.54%) are females. In the same vein, one thousand six hundred and six 1,606 (10.56%) pursued careers in technology based courses at NCE level in all the colleges sampled for the study. Out of this number, one thousand and fifty-three 1,053 (2.88%) are males while 553 (1.51%) are females.

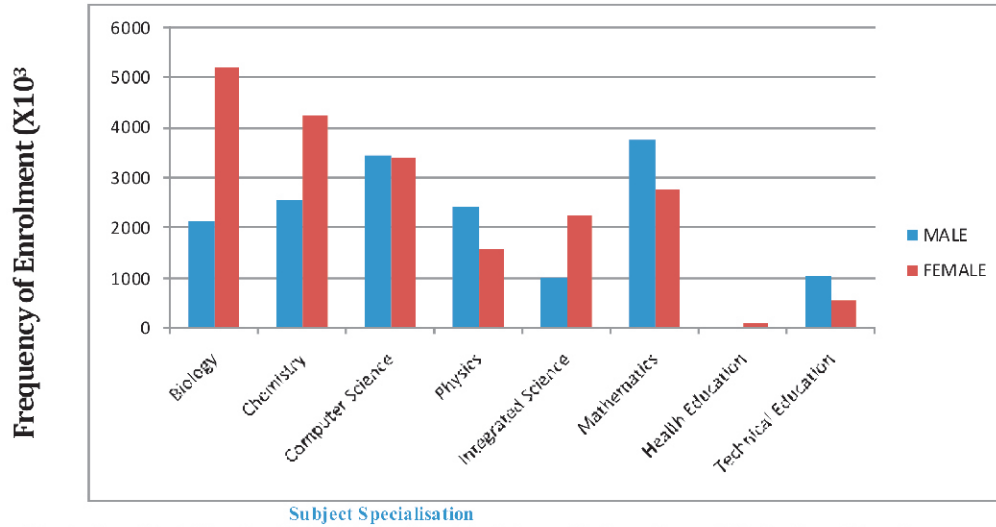


Fig. 1: Bar Chart Showing Students' Enrolment in Science, Mathematics and Technology Education Based on Gender

Figure 1 (d) is a pictorial representation of subject by subject analysis of the students' pattern of enrolment in the Basic and Applied sciences, mathematics and technology Education. It revealed female domination in the core sciences except physics, with higher males than females :Mathematics also enjoys male domination. The same goes for technology Education where almost double the number of females that enrolled are males.

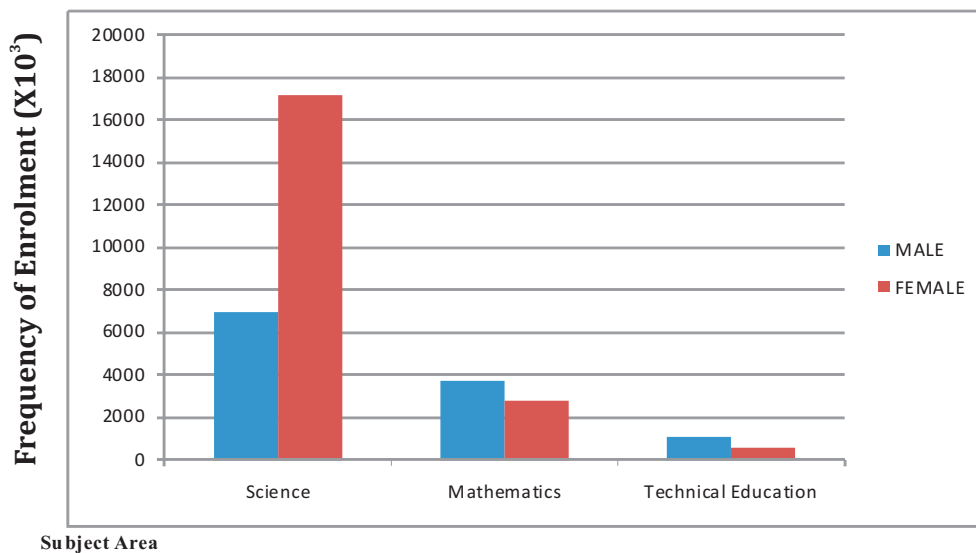


Fig. 2: Comparison of College Students' Pattern of Enrolment in Science, Mathematics and Technology Education Based on Gender.

Figure 1 (e) gave a pictorial description of the students' pattern of enrolment in science, mathematics and technology education, based on gender. Basically, it compares students' enrolment in the sciences, mathematics and technology education with emphasis on gender. It reveals female dominance in the sciences in general over their female counterparts. The reverse is the case with mathematics and technical education both of which were

Table 2: sessional college of education students' enrolment in science, mathematics and technology education .

S/N	ACADEMIC SESSION	MALE		FEMALE	
		N	%	N	%
1.	2005/2006	1063	2.91	1478	4.05
2.	2006/2007	1152	3.15	1676	4.59
3.	2007/2008	1130	3.09	1528	4.18
4.	2008/2009	1204	3.30	1731	4.74
5.	2009/2010	1209	3.31	1727	4.73
6.	2010/2011	1870	5.12	2544	6.97
7.	2011/2012	1803	4.94	2247	6.15
8.	2012/2013	1276	3.49	2867	7.85
9.	2013/2014	1903	5.21	2686	7.36
10.	2014/2015	2432	6.67	2980	8.16
	TOTAL	15,048	41.12	2146	58.78

Table 4.5 gave a detailed analysis of students' enrolment in Science, mathematics and Technology Education , in College of Education in the southwestern Nigeria, based on gender on sessional basis. As discussed earlier, the result of the analysis revealed no marked difference in students' enrolment pastern in the first five out of the ten years investigated in this study (i.e 2005/2006 to 2009/2020). On the basis of gender, there appears not to be remarkable variation in the proportion of male and female students that enrolled in the three major areas that were investigated in the study.

However, in the last five out of ten academic sessions considered in the study, there were progressive increase in the number of students that enrolled to pursue careers in science related fields, mathematics and technology education. In terms of the number of male and female students enrolment in the subject areas, there was also observed progressive increase in enrolment of students. The only exception was in 2012/2013 with the least enrolment during the second half of the period under investigation. In all the sessions investigated there were more females than who enrolled for courses in the sciences, mathematics and technology education, one wonders where the male students' were.

Table 3. Gender differences in Attitude

Comparison of Students' attitude to SIME based on Gender.

S/N	Students' Gender	N	\bar{X}	S.D	Cal. t	Critical t-value
1	Male	16438	58.61			
2	Female	20076	62.71	3.49	0.80	1.96
	Total	36,514				

Table 3 shows the result of data analysis Company College Students' attitude toward SIME the result of the analysis shows that there is no significant difference between male and female students towards SIME. This is because, the calculated t-value 0.80 is less than the critical value of 1.96 at 0.05 level of significance.

Discussion of findings, Implication and Recommendation

On a general note, more female students enrolled in science, Technology and mathematics education relates careers in colleges of Education during the period under review of the total number that enrolled in science related Courses, 55.07% are females while only 44.93% are males. The result of data analysis also revealed that majesty of the Female students have preference for Biology and offered

combinations that are Biology related, this finding may not be uncouncted with the general belief that Biology is feminine in nature and it is the least mathematical of all the sciences. This observation is line with the findings of Onocha and Okpala 1995, Okpala and Onocha 2000, Adesoji, 2005 when they obtained in their different related strong sciences such as Chemistry are Physics are considered as masculine within African settings. Adesoji found that Biology is less mathematical, hence the more

preference for it by most female students especially at the secondary level.

Conclusion

A number of factors have been identified that influence students' academic achievement, choice of subject and indeed attitude towards the subject. In education studies, the role of gender as it affects students' choice of science and science related subjects has also been a major and recurrent issue. Evidence abound that academic achievement, choice of a subject and attitude towards learning the subject are inseparable. The present study has also confirmed the inseparability of these three variables. It therefore underscores the need for practising teachers of science, technology and mathematics to re-direct their efforts at ensuring conducive learning atmosphere that will enable students develop the right attitude and encourage them to enrol in Science, Technology and mathematics education. Teachers should also avoid any form of gender bias and provide a level plane ground that will enhance equal learning opportunities by both male and female for adequate representation in SIME at higher level.

Implication

The implication of this is that practising science teachers should use more participatory teaching strategies and create conducive learning environment that will give all students, the opportunities to learn all science especially at the secondary School level. However, these approaches should be such that are devoid of all forms of gender bias; either overtly or covertly for a nation to be rated high among the comity of nation, participation in SIME should be open to all irrespective of gender affiliation. All professions require the participation by both male and female. For instance professions such as medicine, pharmacy, engineering, information and communication technology require adequate female representation and they should not be seen as meant for males alone. This will afford both boys and girls the opportunity of enrolling in these so called masculine subjects, therefore increasing their participation as higher levels of Education such as college of Education.

In all subjects considered for investigation in this study there was female domination, except in physics, mathematics and technology education to the observed large number of female enrolment in biology related courses, at the expense of physics, mathematics and Technology Education goes a long

way to confirm why there is the scarcity of mathematics and physics teachers in secondary School nowadays. If the number of prospective teachers (e. g at the College of Education level) is low at the tertiary level, certainly, there will not be adequate teachers to handle these subjects at the lower level of Education.

Furthermore, that higher female enrolment means that more females will find their ways into the teaching profession with low male representation. This is so because this category of teachers are the ones expected to teach at the basic level of Nigeria Education system. This perhaps indicates that more males would have enrolled in other fields of humans endeavour than teaching profession which is generally regarded more less a profession for the female gender. In the same vein while higher number of female students enrolled for careers in the science, some science subject i.e physics mathematics and technology education recorded higher male enrolment than females.

It further implies that teaching of these subjects will witness low female participation at the basic level of Nigeria Education.

Recommendation

In order to redress or reverse the situation or strike a balance in students' enrolment in these very important subject areas all hands must be on deck.

Appropriate authorities should put machineries in motion to provide level plane ground which enable both male and female students participating fully in all areas of science, technology and mathematics education.

Practising science and technology teachers should avoid any form of discrimination in the basis of gender during classroom interaction. If this is enforced, in schools, there will be equal opportunities for both male and female students to learn and achieve, then enrol in the subjects at the higher level of Education.

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