International Journal of Quantitative and Qualitative Research Methods
Vol.7, No.3, pp.8-16, June 2019
Published by European Centre for Research Training and Development UK (www.eajournals.org)

GENDER DISPARITY AND STUDENTS' MATHEMATICS ENROLMENT IN CROSS RIVER UNIVERSITY OF TECHNOLOGY, NIGERIA: A TREND ANALYSIS

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ABSTRACT: *This study examined the Mathematics enrollment trends of male and female students of Cross River University of Technology for ten (10) academic sessions (2008/2009-2017/2018). The students examined were those with biases in Mathematics Education and Maths/Statistics. A total of 797 students were purposively sampled for the study. The researchers adopted Trend Analysis as the design to examine the patterns of Mathematics enrollment by the students. Three null hypotheses were formulated to guide the study. The first two hypotheses were tested by Simple Linear Regression Analysis Technique while the third one was tested by the Fisher's Z-Transformation Technique. All the tests were carried out at .05 significance level. The results indicated no significant trends for male and female students' Mathematics enrolment. There was equally no significant difference in male and female trends of enrollment in the subject. It was recommended, among other things, that only those who have enlisted properly as professional teachers, with bias in Mathematics should be allowed to teach the subject. This may address irregularities associated with teachers' attitude towards students and the subject itself, which ultimately affects enrollment in the latter.*

KEY WORDS: Trend analysis, Mathematics enrolment, Academic sessions.

INTRODUCTION

Nigeria is in the League of Nations that advocate for the provision of equal educational opportunities for both the boy and the girl child. National development, according to Salman, Yahaya and Adewara (2011), is a collective responsibility, which calls for the collective efforts of citizens, irrespective of diversities. They believe that countries like the United States of America, China, Japan and Britain, have continued to record developmental success stories through the contributions of their educated male and female citizens. Indeed, the advocacy for gender parity and equality in educational opportunities has long being a global affair. For instance, UNESCO (2012) has, as a critical part of its goals, equal right of access to and participation in education by both boys and girls. These laudable efforts to get male and female citizens of nations to be at par

ISSN 2056-3620(Print), ISSN 2056-3639(Online)

in access to education and diverse fields of learning do not seem to yield the desired results. Even in developed nations, as noted by Leder (2015), where equity in education was supposedly attained long ago, the rates of enrollment of girls in mathematics courses are still relatively low.

Salman et al. (2011) report that literature indicates low enrolment of students in Mathematics Education when compared with other courses in Social Sciences and Arts, especially at the tertiary level of Education. They carried out a study on the spatial and gender patterns of students' enrolment for Mathematics Education in Nigerian Universities. Data for the study were obtained from six Universities randomly selected from each of the six geo-political zones in Nigeria. The data collected were analyzed using both the descriptive and inferential statistics. The results indicated significant gender and spatial differences in the enrolment for Mathematics Education in Nigerian Universities.

Researchers have found significant gender inequalities in Mathematics learning and attitude which most probably account for gender enrolment disparities in the subject. Uwineza, Rubagiza, Hakizimana, and Uwamahoro (2018), investigated the different gender attitudes and perceptions towards Mathematics Education, using questionnaires, interviews and classroom observations to collect data from a sample of 150 participants comprising 60 female students, 84 male students and 6 male Mathematics teachers who were purposively selected. The main findings of the study indicated that boys and girls generally demonstrate shared perceptions towards the importance of Mathematics subjects. However, boys manifested more negative perceptions towards girls' ability to perform well in mathematics. Besides, some few females also manifested negative perceptions, which may explain their low confidence in mathematics. A particular trend which was highlighted in the study indicated the role of the teacher in shaping gender differences that are observed in mathematics learning.

Female students' enrolment rate in the sciences, generally, is believed to be very low, especially at the tertiary education level. According to Kola (2012), in most of our Universities, Polytechnics, and Colleges of Education, female enrolment in the sciences or related subjects has remained very low compared to that of their male counterparts. He made a discovery from his review paper on gender enrolment and performance in Science that both enrolment and performance of male students far exceed those of female students. He recommended that scholarships be awarded female students who perform brilliantly in the Sciences.

Recent reports by UNESCO (2017) indicate that gender disparity in Science, Technology, Engineering and Mathematics (STEM) education is quite striking. In higher education, for instance, only 35% of all students enrolled in STEM-related fields are female. At the moment, only 28% of all of the world's researchers are women. Gender stereotypes and biased attitudes compromise the quality of the learning experience for female students and limit their education choices. Some of the concerns expressed were that girls seem to lose interest in STEM subjects as they get older, particularly between early and late adolescence and that the gender gap in STEM becomes particularly apparent in upper secondary education with regards to girls' choices of advanced studies in Mathematics and Science.

Most researchers, according to Doerr (2011), agree that Mathematics is still currently a male-dominated subject. They corroborate their claim with some evidence. First, they hold unto the fact that females are still underrepresented in upper-level Mathematics classes and careers. For example, female undergraduates in Canada who major in Mathematics and Mathematics-related fields represent only one percent of all undergraduates. It is also reported that, women are not only underrepresented in post-secondary Mathematics, but also in the workforce. In the United States, only one-quarter of all workers in Computer and Mathematical Occupations are females. Another evidence given for the wide gender gap in Mathematics education was that males were found to score higher in most standardized national and international Mathematics examinations. Doerr (2011) also noted that females and males have different experiences in school which possibly explains the gender gap in Mathematics. This position was supported by Walls (2010) in Doerr (2011), who believes that, a significant number of children experience discomfort, alienation, and disengagement from Mathematics from very early in their schooling, and that girls end up losing affection for the subject and becoming marginalized learners in the process. Thus, they lose interest, confidence, and achieve less in the subject.

Many factors have been cited as responsible for the obvious gender inequalities in the preference for science based subjects at various levels of learning. Ekine (2013) believes that the persistence of stereotypical attitudes towards the gender roles of women and men has created a pervasive climate of discrimination and entrench stereotypical roles of women in the family and their participation in public life. Olawoye as cited by Salman, Olawoye and Yahaya (2011) pointed out that the preference of some parents toward certain disciplines, girl negative attitude towards mathematics, teachers negative attitude to students, poor methods of teaching and inadequate importance attached to girl-child education by the government and the society as some of the factors. Some societies and religious set up considered the girl-child as secondary to that of boys. Parents & government have failed to provide the conducive learning environment for the female children. Some parents due to misplaced priorities and other petty reasons have left their children in the hands of house help and their teachers alone; they don't have time for their children to encourage them nor teach them anything that will help them in life. The children are left to their fate amidst environmental distractions (Motunruyo 2010).

A study carried out by Dénes Szűcs (2012) in Britain, found that girls showed higher levels of Mathematics anxiety than boys and high levels of Mathematics anxiety were related to poorer levels of mathematics performance. Recent studies such as the Trends in International Mathematics and Science Study (TIMSS) found no gender disparities in 22 of the 42 countries that tested at Year 8, including Australia" (Thomson, Hillman, & Wernet, 2012). And no gender differences were found within any single state or territory. Negative societal beliefs were identified as likely to greatly affect girls' interest and achievements in engineering, mathematics

ISSN 2056-3620(Print), ISSN 2056-3639(Online)

and other technical programmes. For instance, the stereotyped impression about girls' having poor abilities in mathematics, may create the mindset that mathematics is extremely difficult (Hill, Corbett and Rose, 2010). In most cases family members hold females' responsibilities above career or education hence they may "discourage a woman from STEM programmes" (Aja-Okorie, 2013). Family responsibilities of the woman can hinder or slow down career advancement especially when family support is minimal or non-existent (Akinsowon and Osisanwo, 2014). Mugo (2012) posits that the learning environment such as the teaching pattern, school facilities and resources can also affects women's career choice and academic performance.

METHOD

A trend analysis was the design used to establish Mathematics enrolment patterns of male and female students of the University. Three null hypotheses were tested at .05 level of significance. The sample for the study comprised 797 undergraduate students who had enrolled for Mathematics between 2008 and 2018 sessions. These were students with biases in Mathematics Education and Maths/Statistics. Simple Linear Regression Analysis and the Fisher's Z-Transformation Techniques were applied in testing the hypotheses.

RESULTS

Hypothesis 1: There is no significant trend of male students' enrolment in Mathematics from 2008/2009 to 2017/2018 sessions.
The Simple Linear Regression Analysis Technique was applied in testing the hypothesis at .05 level of significance. Academic sessions represent the predictor variable while the dependent variable is male students' enrolment in Mathematics. The results of the analysis are presented in Table 1.

TABLE 1
Regression of male students' Mathematics enrolment on academic session

R	=	.389	Adjusted R-Square	=	.046
R-Square	=	.152	Stanford Error	=	37.93

Source of Variation	Sum of square	df	Mean square	F	P
Regression	2057.503	1	2057.503	1.430	.266
Residual	11510.097	8	1438.762		
Total	13567.600	9			

ISSN 2056-3620(Print), ISSN 2056-3639(Online)

Variable	Unstandardized		Standardized Coefficient	t	P
	B	Std. Error	Beta		
Constant	41.733	25.912		1.611	.146
Academic session	4.994	4.176	.389	1.196	.266

From Table 1, the relationship between number of academic sessions and male students' enrolment in Mathematics was positive (.389). This means that, as academic sessions increase, male students' enrolment in Mathematics increased. The R-Square value of .152 indicates that about 15.2% of the variation in students' enrolment is accounted for by academic sessions. The P-value (.266) associated with the computed F-value (.430) is greater than the chosen level of significance (.05). Based on this outcome, the null hypothesis is retained. This means that there exist no significant trend of male students' enrolment in Mathematics from 2008/2009 to 2017/2018 sessions. For both the regression constant (41.733) and coefficient (4.994), the respective P-values of .146 and .266 are each less than the chosen level of significance. This implies that both regression constant and academic sessions did not contribute significantly to the prediction of male students' enrolment in Mathematics. The mathematical relation may therefore be written as:

Y = 41.733 + 4.994x, where:
Y = male students' enrolment in Mathematics
X = academic session.

Hypothesis 2: There is no significant trend of female students' enrolment in Mathematics from 2008/2009 to 2017/2018 academic sessions. Simple Linear Regression analysis was carried out in testing this hypothesis at .05 level of significance. The predictor variable was academic sessions which female students' enrolment in Mathematics was the dependent variable. The results of the analysis are shown in Table 2.

TABLE 2
Regression of female students' Mathematics enrolment on academic session

R	=	.380	Adjusted R-Square	= .038
R-Square	=	.145	Stanford Error	= 6.863

Source of variation	Sum of square	df	Mean square	F	P
Regression	63.712	1	63.712	1.353	.278
Residual	376.788	8	47.098		
Total	440.500	9			

ISSN 2056-3620(Print), ISSN 2056-3639(Online)

Variable	Unstandardized		Standardized Coefficient	t	p
	B	Std. Error	Beta		
Constant	15.333	4.688		3.271	0.11
Academic session	-.879	.756	-380	-1.163	.278

In Table 2, the R-value of .380 signifies a positive relationship between academic sessions and female students' enrolment in Mathematics. The R-square of .145 indicates that about 14.5% of the variation in female students' Mathematics enrolment is accounted for by the academic sessions. The P-value (.278) associated with the computed F (1.333) is greater than the chosen level of significance (.05). On the basis of this outcome, the null hypothesis is retained. This means that there is no significant trend of female students' enrolment in Mathematics for the academic sessions involved. The regression constant (15.333) had a P-value (.011) less than .05 while regression coefficient (-.879) had a P-value (.278) greater than .05. Thus, regression constant contributed significantly to the prediction of female students' enrolment in Mathematics, while the coefficient did not contribute significantly to the dependent variable. The model can be expressed mathematically as follows:

Y = 15.333 - .879X, where:
Y = female students' enrolment in Mathematics
X = academic session.

Hypothesis 3: Male students do not differ significantly from female students in their trends of Mathematics enrolment from 2008/2009 to 2017/2018 sessions.
To test this hypothesis, Fisher's Z-Transformation Technique was applied. The R-values for both male and female students' Mathematics enrolments were transformed to Z-values and compared using the standard normal Z-test. The computed Z-value was .022 which is less than the critical value of 1.96 for .05 level of significance. Based on this outcome, the null hypothesis was retained. It is therefore obvious to conclude that male students do not differ significantly from their female counterparts in the trends of Mathematics enrolment for the period covered by the study.

DISCUSSION

The test results of the first hypothesis indicated no significant trend of male students' enrollment in Mathematics for the academic sessions covered by the study. This outcome fell short of the positions of many scholars who have cited factors, other than the progression of academic sessions, as accounting for the positive trend in male students' enrollment in science based subjects. Ekine (2013), for instance, believes that the persistence of stereotypical attitudes towards the gender roles of women and men has created a pervasive climate of discrimination. Men are often made to feel

ISSN 2056-3620(Print), ISSN 2056-3639(Online)

that Mathematics-related subjects are their exclusive preserve. Salman, et al (2011) alluded to the fact that male students generally showed positive attitude towards Mathematics.

The trend of female students' enrollment in Mathematics as explained by academic sessions was equally not significant. That is, enrollments did not significantly follow any established pattern as influenced by the progression of academic sessions. Studies, like those of (Denis,2012; Hill, Corbett and Rose, 2010; Aja-Okorie, 2013), found a litany of factors, which the researcher never considered (held constant), as accounting for patterns in female students' Mathematics enrolment. The factors included, Mathematics anxiety, stereotypes, sociocultural believes, and Low self-esteem.

The results obtained from testing the third hypothesis indicated that male students do not differ significantly from female students in their trends of Mathematics enrollment. Apparently, this outcome may explain the fact that both male and female students' enrollment patterns were impacted by variables not factored by the researchers, but which equally influenced the results.

CONCLUSION

A litany of studies on gender disparity in Mathematics enrolment among undergraduate students have examined factors, other than 'time' or 'academic sessions' as correlates. But this study, in filling an obvious gap, undertook rather to investigate the influence of 'time' or 'progression of academic sessions' on the Mathematics enrolment patterns of male and female undergraduate students. This approach actually revealed observed trends in Mathematics enrolment for male and female students. Howbeit, the trends were not statistically significant.

According to the findings of the researchers, academic sessions never yielded any patterns of enrollment in Mathematics for male and female students. Studies, however, abound that link several other variables, such as teachers' attitude towards students, cultural stereotypes, and students' disposition to Mathematics and so on, with Mathematics enrollment trends of students.

Recommendations

(i) Government should make deliberate efforts to put in place or step up campaigns to promote gender role liberalization, as a way to tackle, head-on, the entrenched role stereotypes along gender lines in our society.

(ii) Only those who have enlisted properly as professional teachers, with bias in Mathematics should be allowed to teach the subject. This may address irregularities associated with teachers' attitude towards students and the subject itself.

(iii) Female Mathematics students who perform brilliantly in the subject should be motivated through scholarship awards. This may encourage others to enroll in Mathematics too.

ISSN 2056-3620(Print), ISSN 2056-3639(Online)

(iv) More should be done by Government and non-Governmental agencies, by way of public enlightenments, towards eroding cultural beliefs that undermine girl child education, especially in science-based fields.

(v) Counselling services in schools should be tailored towards raising the self-esteem of female students who wish to enroll in Mathematics or related subjects.

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ISSN 2056-3620(Print), ISSN 2056-3639(Online)