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## **The Shortfall of Female Mathematics Lecturers in Nigerian Universities: Strategies for Promotion and Retention of Prospective Female Mathematics Lecturers**

By Dr. (Mrs.) A.N.G. Alutu & Eraikhuemen. L. (Mrs.)<sup>i</sup>

### **Abstract**

Mathematics is the bedrock of national development. It is a subject without which a nation cannot move forward scientifically or technologically. It has been observed that the level of female participation in Mathematics studies in the Universities is very low and over the years there has been a steady decline. The study involved focus group discussions with the lecturers in Mathematics Department from these Universities from 1995-2000. This paper has established the low level of female undergraduates and female lecturers in Mathematics Departments in the Universities in Edo and Delta States. The major strategies identified in this paper for the promotion and retention of female mathematics teachers are as follows: (a) Early professional counseling of school children; (b) Gender education for parents and teachers; (c) Sensitization seminars for girls in particular. The paper discusses the effects of this shortfall and suggests some of the strategies for promoting enrolment and retention of female students in mathematics studies in the Universities.

*Key Words:* mathematics, female lecturers, Nigeria

### **Background to the Study**

The system of education which was introduced in Nigeria in 1982 after the curriculum conference of 1969 is the 6-3-3-4 system of education now in operation. The '6' represent 6 years of primary education, '3' represents 3 years of junior secondary education which is both prevocational and academic, then the other '3' represents 3 years of senior secondary education which is purely academic and followed by a minimum of 4 years in the tertiary institution for the award of bachelors' degree. The National policy on Education (1998) clearly spelt out that education is an instrument for National development--Section 1(4). To realize this objective, the individual must be trained to become a sound and effective citizen. The technological dimension of this aspect of the development of any knowledge-based society is tied to the scientific breakthroughs, and mathematics is regarded as the "Queen of Sciences".

Mathematics as a subject has permeated all facets of human endeavour. It is required in learning other science subjects. Research evidence has shown that quantitative skills are required in Biology, Chemistry and Physics practical [Kaleijaiye (1979), Ingle & Turner (1981)]. Consequently, students who are not grounded in Mathematics have difficulties in employing Mathematics concepts, principles and skills in the course of their science education. Mathematics due to its utilitarian value--in buying and selling, in recording keeping, in understanding and appreciating nature, in critical thinking and logical reasoning, etc, has the potential to sustain pupils' interest in the formal school system. It is a necessary tool for the realization of the objectives of the Nigerian Universal Basic Education (UBE) program (Eraikhuemen, 2001).

Speaking on the relevance of Mathematics in Technological development, Alio (2000, 18) posited:

Since Nigeria had her independence in 1960, Mathematics education has received and continued to receive emphasis upon the country's bid towards technological and industrial development. Nigeria as a nation recognized that without Mathematics the nation's objective towards technological and industrial development would not be met, hence a special place is accorded Mathematics education in our primary, post primary and tertiary levels of education.

According to Herbor-Peters (2001), Mathematics remains the pivot on which any true science can rest and no true science can succeed without going through Mathematical demonstration. The relevance of Mathematics to human living has been greatly acknowledged. Apart from in science and technology, Mathematics skills are also utilized in such areas as painting, music, management information systems, traffic control, accounting and a wide range of applications (Saddiq, 2001). Makarfi (2001) noted that Mathematics is universal not only in the way it influences the basic sciences, the applied sciences, engineering, and technology, but also in the way it has been made relevant to the development of the social sciences and the liberal arts.

In a paper written by Alutu (1997) on the impact of Guidance Services on implementation of the 6-3-3-4 system of Education, it was noted that only 14% of the schools sampled indicated that the objectives of the National Policy with respect to guidance and counseling services is being realized. Effort should be made to intensify the training of counselors for all levels of the school system. Counselors are to motivate students who have ability to read science and mathematics irrespective of cultural and gender bias.

In another study on the survey of the barriers in the teaching and learning of science in Nigeria implications for counseling Alutu (1996) noted that of all the Sciences, Mathematics was the most poorly performed subject.

It is in recognition of its usefulness that the Federal Government of Nigeria through the National Policy on education (NPE) (1977 revised 1981, 1998) made Mathematics one of the core subjects to be offered at the pre-primary, primary and post primary levels of education. At least a credit pass in Mathematics is a requirement for admission into science, business and engineering courses in Nigerian tertiary institutions. The Federal Government of Nigeria has made all these efforts in a bid to popularize Mathematics and improve its teaching and learning in schools.

Science, Technology and Mathematics (STM) have been emphasized in the NPE (1998) as the main thrust of our nation's technological development. The year 2000 had been projected as the year to mark the golden age on Science and Technology. However, due to poor implementation of the policy, objectives of STM as contained in the curriculum and the expected breakthrough is not yet realized.

### **Female Participation Assessments**

It has been observed that the level of female participation in STM is Low. Ntunde (1997) in his research on Gender issues in enrolment into Science, Mathematics and technology based disciplines, made use of statistical data of all students enrolled into all departments of two selected tertiary institutions in Enugu State of Nigeria from 1990 to 1996 academic session. He discovered that female enrolment into departments tend to be more towards the management

sciences, education and social sciences, with low enrolment figures in the sciences, Mathematics and technology-based courses in the faculties of Engineering Natural and Applied Science and Technology.

Eboh and Isong (2000) conducted a study which investigated the participation, achievement and set backs of women in science from two institutions in Nigeria, the University of Calabar and the University of Uyo. Results indicated that generally, the percentage of women in the sciences is less than their male counterparts. It has been reported that women are grossly under-represented in fields that use Mathematics as a tool (Ernest, 1976) and that only 2.2% of those who earned a degree in Engineering are females (Eiden, 1976).

Okeke (1997) compared the proportion of girls relative to boys who enroll in secondary school science subjects, those who pursue STM based courses in higher education as well as casual observations of proportion of girls in science classes in secondary and tertiary institutions or employed as scientists, engineers and technologists. She concluded that female participation in STM in Nigeria is low.

It is now imperative to analyze the shortfall experienced in the Mathematics manpower in our universities and this should be traced back to the primary and secondary school science development. According to Abdulahi (1990) the introduction of science into the school curriculum came with the government involvement in secondary education. He noted, however, that there was an acute shortage of qualified teachers in the crucial areas of physics and Mathematics despite the effort of the Federal Ministry of Education (FME) to recruit such teachers. The NPE recognizing the importance of laying a solid foundation for Mathematics education has placed emphasis on practical activities at the primary levels for STM.

To achieve this, the FME and Youth Development in collaboration with the World Bank assisted education project has identified in-service as a useful technique towards enhancing greater efficiency and productivity of primary school teachers. It is at the primary school level that a solid foundation needs to be laid for further development in Mathematical skills. However, shortage of fund did not allow for a smooth take off of the master training program placed all over the federation to redress the situation.

This study therefore wishes to find a pragmatic solution to this problem of shortage of Mathematics teachers by adopting a focus group discussion with Mathematics teachers on the ground and establishing practical strategies to adopt in promoting and retaining females in the field of Mathematics.

### **Statement of the Problem**

Efforts so far made by the government to promote Mathematics and science education have not yielded the desired result, hence, the observed shortfall of female Mathematics teachers. This paper therefore wishes to fill the existing gap by seeking for innovative, practical and result-oriented ways of solving this problem, which is plaguing, our technological development.

### **Research Questions**

This study is designed to provide answers to the following questions;

- (1) What is the ratio of male to female mathematics lecturers in tertiary institutions?
- (2) What is the observed trend in the ratio of male to female Mathematics graduates between 1995 & 2000 academic sessions?
- (3) What is the ratio of male to female Mathematics students enrolled in tertiary institutions in the 2000/2001 academic session?

- (4) What intervention strategies can be adopted to achieve equity in the participation of males and females in Mathematics?

### **Purpose of the Study**

This study aims at analyzing the shortfall of female Mathematics lectures in the higher institutions in the southwest of Nigeria. It also hoped to come up with intervention strategies that will promote and retain the participation of female lecturers in our higher institutions.

### **Data and Methodology**

This study employed the simple survey method of research. A questionnaire titled "Questionnaire for Mathematics Lecturers" was administered to lecturers in the Department of Mathematics in the three universities in southwest Nigeria. It is a sixteen- (16) item questionnaire, which attempted eliciting information from the lecturers on their views on female participation in Mathematics. A questionnaire was also designed, which was used to collect statistics of students' enrollment and graduation from the academic planning divisions of the universities. The information gathered was carefully analyzed.

Two sets of data were collected for this study, qualitative and quantitative data. Items 1-8 of the questionnaire tapped information on demographic characteristics of the respondents. The quantitative data were collected with questionnaires designed for this purpose.

### **Results and Discussion**

Table I shows the statistics of Mathematics lecturers in the three universities studied. The ratio of male to female lecturers was seen to be approximately 16:1. Out of a total population of forty-seven (47) mathematics lecturers in the three universities only three (3) are females. This is an indication that there is indeed a shortfall of female mathematics lecturers in our higher institutions of learning.

Table II shows the classification of graduating students according to sex. The total number of graduating students for university No. 1 during the past five years (1995-2000) is two hundred and sixty five (265) males as against one hundred and twenty four (124) females for the undergraduate class. The ratio of male to female is approximately 2:1. The postgraduate school only turned out twenty-two (22) Master's graduates with only one (1) female. This is a clear indication that most females do not opt for the single honours programme in Mathematics but rather prefer combined honours or professional courses that are mathematically based. The statistics collected for university No. 3 also follow the same pattern. During the past five (5) years (1995-2000), two hundred and sixty (260) male mathematics graduates were produced as against one hundred and sixty nine (169) females in the ratio of approximately 2:1 as was recorded in university No. 1.

Looking at the enrolment figures of students according to sex and level at 1999/2000 academic session for universities No. 1 and 2, and 2000/2001 academic session for university No. 3 (tables IIIa, IIIb and IIIc respectively), it can be observed that the ratio of male to female students enrolled at the undergraduate levels is approximately 2:1. At the post-graduate levels, university No. 1 has an enrolment of male to female ratio of approximately 6:1; University No.2 has an enrolment ratio of male to female equals 6:0 while University No.3 has no students at the post-graduate levels.

These findings corroborate the research findings of Ntunde (1992), Eboh & Isong (2000), Ernest (1976), and Okeke (1997). These studies reported that Nigerian Women and Girls are not

participating fully in mathematics and mathematics based disciplines. Eboh & Isong (2000) attributed this trend to ignorance and cultural beliefs of the area. According to the report, the people of the area believe that women's education is a poor investment. They agreed that since they will be "married out", the benefits go to their prospective husbands. Customs of the area also spell it as taboo for women to compete with their male counterparts in job opportunities and emphasized that women are intended for child bearing.

In the same vein, Adegboye (1998) observed that 68% of parents do not want their daughters to study sciences. This is reflected in their policy on education for their children and this has an impact on the choice of Mathematics as a career by the female children. Commenting on the effects of psychological and social factors on the African female career choice, Anjo (2000; 221) remarked:

although researches show that science performance and technological skills are not completely sex-bound, males psychologically are more favoured to choose and excel in some sciences and science aspects and are more socially accepted and encouraged in sciences than their female counterparts... it is lamentable that often education is taken lightly and often individuals do not aspire to acquire knowledge and skills appropriate to their aptitude and interest due to stereotyped tendencies.

However, the focus of this study is not just the advancement of reasons for the low participation of Nigerian girls and women in the field of Mathematics but on intervention strategies that will promote and retain the participation of females.

### **Qualitative Analysis of Data**

The content analysis of the information generated through in depth interview can be presented fewer than six main themes.

*Theme 1:* What intervention strategies should be employed by the government to increase female enrolment in Mathematics?

- (1) Ready employment and good salaries for female Mathematics graduates.
- (2) Government should give necessary incentives.
- (3) Reading materials should be provided for female Mathematics undergraduates.
- (4) Awarding of Scholarships to those intending to study Mathematics or Mathematics combined courses.
- (5) Government should create the enabling environment for effective learning of Mathematics.
- (6) A solid foundation should be laid for Mathematics courses by ensuring that only qualified teachers teach the subject and that the teachers teach well, even right from the lowest level of education.
- (7) Early professional Counseling of school children.
- (8) Gender education for the parents and teachers should be put in the curriculum.

*Theme 2:* What intervention strategies should be employed by the teacher to increase female interest in Mathematics at the primary school level?

- (1) Make Mathematics fun in the primary school.

- (2) Render practical the teaching of Mathematics
- (3) Employ rewards for excellence to motivate children.
- (4) Desensitize the fear of Mathematics.
- (5) Experienced and pain-staking teaching needed at the primary school level.
- (6) Collective participation of both pupils and teachers.
- (7) Gender differences should not be applied in teaching.
- (8) The teacher should be friendly and patient.
- (9) Simplify the teaching.
- (10) Relate Mathematics to real life experience e.g. buying and selling.
- (11) Use teaching aids.
- (12) Give pupils individual attention.
- (13) Sensitization Seminar for girls should be organized at intervals.

Looking at the enrolment figures of students according to sex and level as at 1999/2000 academic session for universities No. 1 and 2, and 2000/2001 academic session for university No. 3 (tables IIIa, IIIb and IIIc respectively), it can be observed that the ratio of male to female students enrolled at the undergraduate levels is approximately 2:1. At the post - graduate levels, university No. 1 has an enrolment of male to female ratio of approximately 6:1, university No. 2 has an enrolment ratio of male to female equals 6:0 while university No. 3 has no students at the post graduate levels.

*Theme 3:* What intervention strategies should be employed by the teacher to increase female interest in Mathematics at the secondary school level?

- (1) Teachers should teach rudimentary concepts in methods that are meaningful to the children.
- (2) Mathematics teacher should serve as good models to the children
- (3) Encourage group work and integrate the show learner
- (4) Make the children feel the relevance of mathematics in everyday life
- (5) Demystify Mathematics. Its application to real or daily life should be emphasized.
- (6) The teachers should be patient, friendly neat and dress well.
- (7) The teachers should be mobilized and supervised
- (8) Use a variety of teaching methods and give a lot of exercises.

*Theme 4:* What intervention strategies should be adopted by parents to increase female enrollment and participation in mathematics?

- (1) Provision of necessary materials for their children
- (2) Encourage the boy-child and girl-child equally
- (3) Supervision of their work at home
- (4) They should give incentives to their female students to motivate them.
- (5) Puzzles rich in mathematics to trigger off their interest
- (6) Parents should educate their girls on the relevance of Mathematics in different professions.
- (7) Parents should organizer and pay for extra private lessons for their girls

*Theme 5:* What intervention Strategies should be adopted by the female students themselves to increase their participation and interest in mathematics?

- (1) Females should develop competitive strategies against males.
- (2) Female should develop high self-esteem.
- (3) Females should engage in focus group study.
- (4) Females should have internal locus of control.
- (5) Females should not fear Mathematics.
- (6) They should be Mathematics friendly.
- (7) They should increase their self-interest in Mathematics.
- (8) They should form reading groups and be persistent in solving problems.
- (9) They should be determined and persevere.
- (10) They should remove the fear of male dominance.

*Theme 6:* Suggest other ways females should be encouraged to enroll and be retained for a career in Mathematics teaching at the tertiary level?

- (1) Female students good in secondary school mathematics should be encouraged to read Mathematics in the University.
- (2) Scholarships should be given to post graduate Mathematics students.
- (3) Ready employment should be provided for Mathematics graduates.
- (4) Desensitize the fear of mathematics.
- (5) Reduce tax payment rate for female mathematics lecturers.
- (6) Provide female Mathematics lecturers with good opportunities for self-development and self actualization.
- (7) Generate staff regulations in favour of women in the field of Mathematics. For example, female Master's degree holders should receive positions of lecturer II rather than Assistant Lecturer. Develop incentives such as car loans, furniture loans, accommodations etc., automatic for female Mathematics lecturers.

**Table I: Statistics of Lecturers in Mathematics Department of the three Universities**

University No.	No. of Males	No. of Females	Total	Ratio Male: female
1	23	1	24	23:1
2	10	1	11	10:1
3	11	1	12	11:1
Total	44	3	47	44:3
Percentage	94%	6%	100%	94:6 $\approx$ 16:1

**Table II a Classification of Graduating Students According to Sex**  
*University No 1.*

ACADEMIC SESSION	FIRST DEGREE		HIGHER DEGREES								Total Number of Graduating Students		
			P/G DIP		MPHIL		MASTERS		PH.D				
			M	F	M	F	M	F	M	F			M
1995/96	16	66	-	-	-	-	-	-	-	-	-	16	66
1996/97	-	-	-	-	-	-	21	1	-	-	-	21	1
1997/98	21	23	-	-	-	-	-	-	-	-	-	21	23
1998/99	-	-	-	-	-	-	-	-	-	-	-	-	-
1999/2000	66	35	-	-	-	-	-	-	-	-	-	66	35
GRAND TOTAL	25	12	-	-	-	-	21	1	-	-	-	27	125
	5	4										6	

Ratio. Male: Female = 276:125  $\approx$  2: 1

**Table II b Classification of Graduation According to Sex***University No. 3*

ACADEMIC SESSION	FIRST DEGREE		HIGHER DEGREES								Total Number of Graduating Students	
			P/G DIP		MPHIL		MASTERS		PH.D			
	M	F	M	F	M	F	M	F	M	F	M	F
1995/96	3	2	-	-	-	-	-	-	-	-	3	2
1996/97	35	28	-	-	-	-	-	-	-	-	35	28
1997/98	87	56	-	-	-	-	-	-	-	-	87	56
1998/99	97	45	-	-	-	-	-	-	-	-	97	45
1999/2000	38	38	-	-	-	-	-	-	-	-	38	38
GRAND TOTAL	260	169	-	-	-	-	-	-	-	-	260	169

Ratio. Male: Female = 260:169  $\approx$  2: 1**Table IIIa: Classification of Students According to Sex and Level in 1999/2000 Academic Session***University No. 1*

LEVEL	UNDERGRADUATE STUDENTS		
	MALE	FEMALE	TOTAL
100	44	26	70
200	98	20	118
300	59	23	82
400	131	93	224
GRAND	332	162	494

TOTAL			
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Ratio. Male: Female = 332: 162  $\approx$  2:1

POSTGRADUATE STUDENTS			
PROGRAMME	MALE	FEMALE	TOTAL
POSTGRADUATE DIPLOMA	-	-	-
MPHIL	-	-	-
MASTERS	11	2	13
DOCTORATE	8	1	9
	19	3	22

Ratio. Male: Female = 19: 3  $\approx$  6: 1

**Table IIIb: Classification of Students According to Sex and Level in 1999/2000 Academic Session**

*University No. 2*

LEVEL	UNDERGRADUATE STUDENTS		
	MALE	FEMALE	TOTAL
100	40	20	60
200	45	30	75
300	65	25	90
400	80	25	105
GRAND TOTAL	230	100	330

Ratio. Male: Female = 230: 100  $\approx$  2:1

POSTGRADUATE STUDENTS			
PROGRAMME	MALE	FEMALE	TOTAL
POSTGRADUATE DIPLOMA	4	-	4
MPHIL	-	-	-
MASTERS	1	-	1
DOCTORATE	1	-	1
GRAND TOTAL	6	-	6

Ratio. Male: Female = 6: 0

**Table IIIc: Classification of Students According to Sex and Level in 2000/2001 Academic Session***University No. 3*

LEVEL	UNDERGRADUATE STUDENTS		
	MALE	FEMALE	TOTAL
100	74	40	114
200	48	22	70
300	68	33	101
400	71	46	117
GRAND TOTAL	251	141	402

Ratio. Male: Female = 251: 141  $\approx$  2: 1

POSTGRADUATE STUDENTS			TOTAL
PROGRAMME	MALE	FEMALE	
POSTGRADUATE DIPLOMA	-	-	-
MPHIL	-	-	-
MASTERS	-	-	-
DOCTORATE	-	-	-
GRAND TOTAL	-	-	-

**Conclusion and Recommendations**

The case has been established that there is a short fall in the number of females teaching Mathematics in the universities in southwest Nigeria. It is the assumption of this study that Mathematics teaching is a great contribution to national development, a course that should not be left for the male folk alone, but the females also should be encouraged to make their contribution. The population of Nigeria is almost 50% male and 50% female and females are underutilized in this domain. Studies have reported that female lecturers at the University level can serve as a role model to motivate the young mathematicians.

This research has shown that only 6% of the Mathematics lecturers in south-west Nigerian Universities are females. This figure is very low.

During the past five years (1995-2000) the ratio of male to female graduate turned out by the Universities is approximately two to one.

The post-graduate school only turned out twenty-two (22) graduate over the period of five years with only one (1) female.

Based on the findings and conclusions drawn from this study, it is recommended that:

- (1) Mathematics should be taught with new approaches starting from the primary School level, play- way method of teaching with audio visual aids should be employed.
- (2) The teachers and parents should de-emphasized gender bias attached to Mathematics.
- (3) Government should support the effort of Non-governmental organization like the STM, and other agencies in promoting science and technology in our Country.
- (4) More incentives should be given to girls who read Mathematics in order to encourage younger Mathematicians.

### **Summary of Qualitative Analysis of Data**

In concrete terms, researches will adopt the intervention process theme by theme to achieve the proposals arrived at under the qualitative analysis. Memoranda will be written to government and non-governmental agencies on improving the conditions of service of Female Mathematics lecturers to encourage the upcoming ones. Through seminars and workshops, innovative teaching strategies will be introduced, as for example, co-operative learning strategies and peer tutoring to desensitize fear of mathematics. Early career counseling is also advocated so that the young scientist will be directed early enough in their career

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