

Strategies for Bridgering Gender Gap in Science, Technology and Mathematics (STM) Education for National Development

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Abstract

This paper discusses the importance of Science, Technology and Mathematics (STM) education to national development. The role of women in STM education to national development was discussed. The State of female enrolment in STM in comparism to that of their male counter part was looked into in some Nigerian institutions. It revealed a low enrolment of females to that of males. It went ahead to discuss the barriers to female enrolments in STM education as well as the possible ways of over coming these barriers. Recommendations were made on how to promote females participation in STM and related courses amongs, which is the provision of adequate security in all institutions of learning, especially for the female students, to keep them safe from being kidnapped, abducted or sexually abused by evil men. As this will solve the problem of parents not sending their daughters to school for fear of them being harmed or losing them completely.

1. Introduction

In the last century resources have been allocated in many parts of the world for developing curricula in school science, which were directed to the need for more scientists that can promote national development. In the light of this, Nigeria as a developing country has emphasized the education of its citizens in science, Technology and Mathematics (STM). This mode was reflected in the National policy on Education when it recommended an enrolment ratio of 60:40 in favour of STM and related courses in higher institution of learning (Federal Republic of Nigeria 2004). This guideline became necessary in order to boost our manpower development and researches in these professions.

The role of STM in the development of a nation cannot be over emphasized as it is very important in solving a country's problem as supported by Imarhigbe (1996) stating that STM is the base for the overall development of a nation, the instrument, the orderly and ethical behaviour of it citizens. In the same vein Fafunwa (1990) stressed that we cannot hope to be self-reliant with other people's science and technology. If we must develop and be self-reliant, we must develop our own science and technology. And since national development has to do with ability to harness all the available resources, human, material or economic to bring out the potentials of a nation, there has to be improvement in well-being. This requires the elimination of hunger and poverty and also providing gainful and productive employment for all the citizens. Nigeria as a developing nation is not left out of this regard that is why the National policy on Education (FRN 2004.7) as cited by Danjuma (2010) provides that "every Nigerian child shall have a right to equal educational opportunities irrespective of any real or imagined disabilities, each according to his or her ability".

It is therefore dishearten that our female – children are lagging behind their male counterparts in education especially in STM. Abundant literature exists revealing the gap between male and female at all levels of education in Nigeria especially in STM where Aguele and Uhumuarbi (2003) found out the ratio of male to female enrolment in STM in some Nigerian Universities to be 3:1 in the 2000/2001 academic year. Kinshore (2008) also agreed that the participation of females in STM education has been and is still low around the world.

Some of the factors that hinders females from participating in STM education as pointed out by King 2000, and UNICEF 2007 among others as parents negative toward the education of their daughters, the nature of science, shortage of female teachers in STM to serve as role models, poverty, the persistence of stereotypical attitudes towards the gender roles of women and men. In order to get the female into the mainstream of STM education and empower them sufficiently for national development, parents should be educated on the changing role of parenthood and be trained on how they can lay the basic foundation of their children in STM and the language of instruction. Teachers should be sensitized to be gender friendly and practice gender inclusive learning environment in the classroom and female that have made it in STM education should serve as resources persons to schools in order to motivate female students to study STM courses. But despite all the efforts taken so far, the problem of low enrolment of female in STM education still

persist. It is therefore against this background that this paper examined closely the factors responsible for the poor enrolment of female in STM and how to solve it.

2. The State of Gender Enrolment in STM Education

Recently there has been a growing consciousness both at the grass roots and policy levels regarding the impact of gender issues in education. This consciousness has brought about a growing concern on gender factor in enrolment at all levels of education. More particularly disturbing is the issue of female enrolment in STM. This is due to role of STM in the development of nation. In Nigeria, literatures revealed the gap between male and female in the enrolment in STM both the secondary and tertiary institutions.

A research by Danjuma (2010) on the enrolment of the girl child into STM in Taraba State revealed that in Government Senior Science Secondary School Jalingo, the total number of girls offering science subjects was 85 (34.4%) and that of boys was 162 (65.6%) leaving a gap of (31.2%). At Government Senior Technical Training school Jalingo the total number of girls offering Technical subject was 313 (27.3%) while that of boy was 835 (72.7%) a gap of (45.4%). At Federal Science and Technical College, Jalingo: Department of Science, the total number of female was 26 (22.4%) and that of boys was 90, (77.6%) a gap of (55.2%). At Federal Science and Technical College, Jalingo: Department of Technical, the total number of female students was 19 (18.1%) and that of male students was 86 (81.9%) a difference of (63.8%). At College of Education, Jalingo NCEI, the total number of female students in the sciences was 63 (33.2%) while that of boys was 127 (66.8%) a difference of (33.6%). In technical department, only 4 (12.5%) female students while there were 28 (87.5%) male students. And in mathematics department there were 15 male students while no female student was enrolment. This shows that there is a wide gap in the enrolment of male to female students in STM education. Another study by Salman, Yahaya and Adeuera (2011) revealed the gap in male and female student's enrolment in mathematics education at a College of Education and a University from (2003 – 2008).

Table 1: Students' enrolment in mathematics education at a college if Education and a university from 2002 – 2008

Academic Year	College of Education Lafiaji		University of Ilorin	
	M	F	M	F
2003/2004	28(96.55)	1(3.45)	66(70.21)	28(29.79)
2004/2005	40(93.02)	3(6.98)	13(61.90)	8(38.10)
2005/2006	35(92.11)	3(7.89)	15(68.18)	7(31.82)
2006/2007	117(90.70)	12(9.30)	14(60.89)	9(39.13)
2007/2008	45(88.24)	6(11.76)	21(70)	9(30)

Values in bracket are percentages

Source: Salman, Yahaya and Adeuera (2011)

The enrolment of the female students in mathematics education is the college of education as indicated in the table above is very poor in all the sessions. While that of the university is better with the highest percentage of 39.12% in 2006/2007 academic session.

Another survey by Salman Olawoye and Yahaya (2011) reveals the following enrolments

Table 2: Enrolment pattern of candidates in STM subjects in the 2004 Senior Secondary School Certificate Examination based on sex.

STM Subjects	Total No. of candidate	No. of Males	%	No. of Females	%
Further Maths	18557	14732	79	3825	21
General Maths	832689	446907	54	385782	46
Agric Science	656599	369893	56	286706	44
Biology	821966	439358	53	382608	47
Chemistry	269774	159533	59	110241	41
Health Science	12306	5586	45	6719	55
Physics	265262	158402	95	106860	41
Applied Electricity	389	337	87	52	13

STM Subjects	Total No. of candidate	No. of Males	%	No. of Females	%
Auto Mechanics	169	166	98	3	2
Building Construction	200	178	89	22	11
Electronics	245	200	82	45	18
Metal Works	570	562	99	8	1
Technical Drawing	7490	6462	86	1028	14
Wood Work	499	488	98	11	2
Clothing and Textile	541	15	3	436	97
Food and Nutrition	16903	1196	7	15707	93
Home Economics	11066	475	4	10591	96

Source: Salman Olawoye and Yahaya (2011)

Table 3: Another research by Ekine (2013) revealed another gap in the enrolment of male and female students in some science teaching subjects.

Subject	No. of male	No. of female	Percentage of female
Biology	92	259	73.8
Computer science	285	210	42.4
Information and Communication Technology	162	97	37.5
Petrochemical Science	236	98	29.3
Health Education	105	224	68.1

Source: Ekine (2013)

Table 4: Further survey revealed the following enrolment of 100 and 200 level students of school of sciences Federal College of Education (FCE) Pankshin Plateau State. Admission List 2013/2014 Academic Session, School of Sciences FCE Pankshin

Subject	100 Level			200 level		
	No. of Male	No. of Female	% Female	No. of Male	No. of Female	% Female
Biology	23	12	34.4	12	4	25
Mathematics	11	2	15.4	16	4	20
Physics	16	1	5.9	13	2	13.3
Physical and Health Education	2	0	0	21	6	22.2
Integrated Science	8	10	55.6	9	4	30.8
Chemistry	15	7	31.8	13	2	13.3
Computer Science	25	6	19.4	13	4	23.5

Source: Admission Office FCE Pankshin

Table 5: Technical Education Department FCE Pankshin

Subject	100 Level			200 level		
	No. of Male	No. of Female	% Female	No. of Male	No. of Female	% Female
Technical Education	7	0	0	32	0	0

Source: Admission Office FCE Pankshin

From each of the tables above, the enrolment of female student in STM courses/subjects are lower than that of the male students except in table 2 where subjects like clothing and textile, Food and Nutrition & Home Economic that the female students are the majority. In Biology and Health Education too in table 3, the number of female students' enrolment outnumbered the male students.

3. Problems of Female Enrolment in STM Education

Over the years, the role of female in Nigerian society has been erroneously conceptualized to child bearing and house keeping that's why in most developing countries males are groomed for career in technical and scientific field while females are guided to concentrate their efforts on home economics. Where the females are misguided early in life not to participate in technical and science related activities they develop a negative image toward STM education and has accounted largely for the low enrolment of females in these subjects particularly in the universities (Lawrence, Aguele and Agwagah (2007). Similarly according to Ekine (2013) 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.

Other factors as identified by Oke (2000) is the nature of science, home background, classroom practices, curricular materials, assessment practices and early marriage. In the same vein Olawoye as cited by Salman, Olawoye and Yahaya (2011) indentified 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 the waves of environment distractions (Motunruyo 2010). And on the other hand the government seem to pay less attention to education at the primary level, No properly monitoring and so the teachers neglect to do their work which resulted in the poor performance of students in secondary School where the selection of STM students are made. This also resulted to the low enrolment of female students in STM. Therefore the low enrolment of female in STM can be due to parents and society's ignorance, poverty and lack of skills to handle female children with poor background or lack of interest in STM and the government for not proper monitoring of teachers at the primary school level where the foundation is laid.

4. Strategies for Bridgering the Gap

Since science, Technology and Mathematics education is very crucial to the development of any nation, and given the fact that female is the mother of nation, her education in science, Technology and Mathematics (STM) therefore place her in a better position to facilitate the development of her nation.

As the population saying "if you educate a man you educate an individual but if you educate a woman you educate the nation" Therefore any nation that desire a genuine development cannot continue to ignore the education of its female citizens in STM. As in the words of Annan (2011) of the United Nations.

No development strategy is better than one that involves women as central players. It has immediate benefits for nutrition, health and savings and reinvestments at the family, community, and ultimately, country level. Educating the girl child is a social development policy that works and a long term investment that yields an exceptionally high return.

Therefore with these benefits in mind, the following strategies are given for bridgering the gender gap in STM education.

Parents should have equal regard to their children in respective of their sexes. They should allow and encourage their daughters to participate in activities that will enhance their skill in science and encourage them to study their book. Parents should not engage their daughters with too much house work that will not allow them to study their books. They should also be provided with good study materials at home, restricting them from wasting too much time on watching un-educational programmes. Science oriented parents should teach their children science at home or employ someone to do it. This should be done early in the child's life to give a good foundation for STM education at higher levels. Parents should also closely monitor the movement of their children especially the female children after school hours to avoid being harass, kidnap or rape that may lead to unwanted pregnancy.

The roles of the teachers, next person that influence the children is the teacher after his parents. Teachers especially at the primary school level should engage the young children both male and female in activities that will help in developing their skills in science, the right stage for the development of cognitive and non cognitive skills that can lead to greater achievement later in life (James carted by Ekine (2013). Similarly a research on brain development shows that the thinking skills necessary for problem solving are best developed between the ages four and twelve (Ekine 2013). Science teachers should also use various methods of teaching to suit the level of the learner. At the primary School,

activity and story telling methods are more effective as these methods get the interest of the female children early in life before they become discouraged. At secondary school level science teachers should employ guided and discovery methods to help the students discover most of the science concepts by themselves, this gives them confidence in the subjects and help them to remember what they learnt easily. High degrees of interaction between males and females science technology & mathematics students also help the female students to learn STM from the male students. Teachers should therefore encourage this through sitting arrangement and grouping of students.

The government on the other hand, should provide conducive learning environment, equipped laboratories for the teaching and learning of STM. Textbooks and other learning materials should be provided by the government. More attention should be given to primary school teachers as they are the ones that lay the foundation of education to the children. They should be monitored and their salaries and other allowance paid on time.

In the same vein, females that have made their mark in STM education should serve as mentors and role models to the female students from the early stage. Such females should be invited to speak to the students on career days or any other days as the need arises as this go a long way in encouraging the female students to study STM and elated courses. To bridge the gap between male and female enrolment in Science, Technology and Mathematics education is therefore the responsibility of parents, teachers, educators, governments, NGOS and all lovers of Nigeria. This is because of the role of female in STM to national development. According to Khoo as cited by Danjuma (2010) "As societies open up, they often create new opportunities for women, but those opportunities are lost when they are not trained to assume such roles".

5. Conclusion

Nigeria as a developing nation, need more scientists, technologist and mathematician to be able to position herself properly in the committee of nations and consistently address issues regarding national development. Therefore Nigeria needs to education more of its citizens in science, technology and mathematics education. The females who out number the males and as mothers of nation should be encourage to take active part in this, for our country to attain a meaning development.

6. Recommendations

In order to bridge the gap in male and female enrolment in science, Technology and mathematics education and empower them sufficiently for national development, the author recommends the followings:

1. Efforts should be made to address the perceived lack of relevance of work in tertiary institutions. There should be a restructuring of undergraduate STM curriculum to include more investigative learning, technology, laboratory experience and collaborative work. Programmes that provide students opportunity to engage in hands-on, real life projects would be successful in creasing female enrolment and retention.
2. Primary school should be equipped with the right kind of resources and manpower for effective learning. Female should be targeted at this level when fundamental knowledge and skills are being acquired, when interest can be most easily sparked, and when the greatest numbers of both males and females are found.
3. Parents must be made to understand the benefits of educating their daughters in STM through community based information dissemination techniques. The use of mass media like televisions and radios which most people do not have access to should be reduced and town criers, village based crusades and enlightenment programmes, use of religious center and market awareness activities carried out and on regular basis.
4. Automatic employment opportunities should be provided for female graduates in STM courses by government and other employers of labour. They should be sent on for further studies in developed countries on in service. Their condition of service should be made an envy of all. This will attract more females to the fields.
5. Female students that show interest in STM education should be sponsored by the government right from the secondary school to tertiary level. This will motivate both parents and the females students to study STM course.
6. The points required for admission into tertiary institutions for STM courses has to be made lower for females student than their male counterparts. This will boost the number of female that may be admitted into tertiary institutions in these subjects.
7. Adequate security should be provided in all institutions of learning, especially for females to keep them from being kidnapped, abducted, or sexually abused by evil men. This will solve the problem of parents not sending

their daughters to school for fear of being harmed or of losing them completely.

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