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# Gender differentials in science, mathematics and technology: why do fewer females participate in science, mathematics and technology courses in Nigeria?

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**This paper discusses the problem associated with gender differential in science, mathematics and Technology (SMT) in Nigeria. Data for the study were obtained from a survey conducted in March, 2005 in two Local Government Areas of Osun state, Southwest Nigeria. The paper confirms the earlier assertion that female are underrepresented in SMT. It also reveals that: more than 70% of the household heads, 61.2% of mother and 64.4% of children accepted that there was gender disparity in SMT; socialization processes inculcated gender biases through the different roles and responsibilities assigned to girls and boys. A package of communication strategies are therefore recommended to sensitize people on the need for girls to be actively involved in SMT.**

**Key words:** Imbalances, community, household, assessment, cultural, performance.

## INTRODUCTION

In spite of the various actions and inputs by government as well as intervention by Non-Governmental Organisations (NGOs), religious organizations and international organizations, girls still lag behind boys at all levels of education. They continue to avoid courses, which lead to careers in science and technology.

Deeper forces in society that extend well beyond the boundaries of educational systems, institutions and processes cause gender inequality in science, mathematics and technology (SMT). As observed in some studies (Alele-Williams, 1988; Adelman, 1991; Morgan, 1992; Erinosh, 1994; Kahle and Meece, 1994), the basic causes of gender discrimination against women involvement in education generally, are deeply rooted in socio-culturally determined attitudes. The socio-cultural factors include patriarchy which encourages and perpetuates discrimination against females, sex stereotype, division of labour in which domestic chores at home are assigned to females. All these factors tend to discourage females from more active participation in science and technology.

For instance, in some homes, particularly of illiterate parents who still form the majority of Nigerian population, given the literacy level of less than 50%, education of boys is given priority and more prominence in view of the need to perpetuate family name in a competitive society.

Furthermore, the cultural division of labour stereotypes certain careers as unfeminine and incompatible with marital demands. Largely because majority of science and technology-related careers have in-built inflexibility in work schedules, requiring those involved to be taken out of their homes to the laboratory or the field, they are believed to be incompatible with feminine responsibility to meet the dual-role demand of home and work. Consequently, majority of girls with potentials for technical and scientific skills, are discouraged from pursuing SMT subjects. As observed by Kahle and Meece, (1994), it is not that girls cannot and do not have the ability to succeed in science, mathematics and technology courses, but rather that obstacles arise in recruiting and retaining girls.

Studies have also, shown that girls are facing many obstacles caused by societal ills such as poverty (Alele-Williams, 1988; Erinosh, 1994). Because girls are still largely under-valued by society, when family members become incapacitated by illness or old age, girls are often

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**Table 1.** Distribution of respondents by whether or not there is gender disparity in SMT

Gender Disparity		Local Government Areas		
		Oriade	Ifedayo	Total
Household heads	Yes	72.5 (70)	69.7 (64)	71.1 (134)
	No	27.5 (27)	30.3 (28)	28.9 (55)
Mothers	Yes	39.8 (39)	82.5 (79)	61.2 (119)
	No	60.2 (60)	17.5 (17)	38.8 (76)
Children	Yes	41.6 (43)	87.2 (69)	64.4 (118)
	No	58.4 (61)	12.8 (11)	35.6 (66)

the first to be relegated to the caregiver status and thus further compromising their chances of self-development and success. They are also the most defenseless and vulnerable, hence, they are more open to rape, sexual harassment and gender-based violence in schools and society (Adelman, 1991).

Since there are no policies against gender balance in science and technology activities and access to educational institutions enjoy reverse discrimination in favour of females, the constraints against parity in participation or performance in science and technology are mainly socio-cultural, economic and of teaching/learning process factors. Research is essential to up-date knowledge and information on this subject matter. This paper, therefore, open up new areas on how to overcome socio-cultural and economic barriers associated with gender differentials in science, mathematics and technology and encourages more girls to study science and technology and ultimately play an important role in technological development of the country in particular and developing countries in general.

## METHODOLOGY

The study was carried out in Osun state, Southwestern Nigeria. Osun state stands out clearly as one of the educationally advantaged states in the country with her literacy level as high as 61.98%. This is above the national average of 49.44%. More than 95% of children in the state attend primary school compared with 76% for the whole country. As at 1995 the state has a total of 1189 primary schools with population of 522,500, 328 secondary schools with a student population of 214,057 and the schools' attendance records show a total percentage of 40.81% representing 45.19% males and 36.6% females (Osun State Ministry of Education, 1995). Within the state, Ifedayo Local Government Area (LGA), the LGA with the highest gender gap and Oriade Local Government Area, the LGA with highest literacy and enrolment rates were selected for the study.

The total population of Ifedayo LGA, according to the 1991 census, is 43,287; the projected population figure as at 2003 is 58,870. It is populated predominantly by the Yoruba ethnic group. This local government area was chosen because of the apparent gender disparity in literacy and enrolment and the poverty of the area. A situation analysis carried out in the LGA in 2001 estimated the female literacy rate at 41.7% compared with 58.4% for boys. Available statistics for Oriade local government portrays a LGA with higher female literacy and enrolment rates (48.7% for girls compared with 51.6% for boys). The total population of Oriade LGA as at 1991

was 80,833 (39,283 males and 41,550 females) with 17,967 households. The population of the LGA is projected to be about 109,932 as at 2003.

A household survey and qualitative studies were carried out in the selected Local Government Areas. The interview schedules were coded and analyzed with the SPSS version 11 Descriptive statistics such as percentages, frequency tables, cross-tabulations, were used to present the vast quantitative data collected.

A total of 189 household heads and 195 women with school-age children were successfully interviewed in the selected households. Of the 195 women, 50.7% were drawn from Oriade and 49.3% from Ifedayo LGA. Also, 184 children of school age were included in the study sample, of which 56.3% were interviewed in Oriade and 43.7% in Ifedayo. Boys slightly outnumbered girls; the proportion of boys being 51.8% compared to 48.2% girls. The samples were predominantly Yorubas with 96.7% of household heads and 95.3% of mothers. Only 4.6% of the household heads were females. About 66% of the household heads are in age group 45-64 years. Majority of the mothers were also in age group 35 - 49. Household heads with formal education generally received some primary education. Majority of the mothers (64.1%) also had no formal education, while those with some form of formal education mainly had basic education (that is primary education). The children, however, have a better chance of being educated. About 75% of children in the household records were currently enrolled in school, 77.3% boys and 73.6% girls. In Oriade, 84.5% of the female children and 81.2% males were in school. This confirmed the official statistics, which reported higher enrolment for females than males in this LGA. In Ifedayo, 73.4% of sons compared with 62.7% of the daughters were in school. Christianity and Islam were the two principal religions practised by all categories of respondents. There are more women in monogamous unions in Oriade than in Ifedayo probably due to the higher level of exposure to education and the dominance of Christianity.

## Is there gender disparity in SMT?

Respondents gave their subjective opinions about the level of gender disparity in science, mathematics and technology (SMT) at the community level. The majority held the general belief that more girls than boys were disadvantaged. As shown in Table 1, more than 70% of the household heads, 61.2% of mothers and 64.4% of children accepted that there was gender disparity in SMT education in favour of boys in their communities. Among the household heads who accepted that there was some disparity, the majority (72.5%) were from Oriade. Only 39.8% of the mothers and 41.6% of the children claimed that there is gender differential and thus believe that girls are not underrepresented in these courses. This showed lack of awareness of the significance of the problem (Table 1).

## Causes of gender differentials in SMT

The causes of gender disparity in education are too widely known

**Table 2.** Percentage distribution of respondents by causes of gender disparity in SMT

Causes		Local Government Area		
		Oriade	Ifedayo	Total
		(N=97)	(N=92)	(N=189)
<b>Household head</b>	Teachers' behaviour	9.7	7.1	8.4
	Government attitude	4.2	6.7	5.5
	Financial constraints	15.4	25.1	20.3
	Bad economy	13.5	13.4	13.5
	Early marriage	0.8	4.4	2.6
	Preference for boys education	4.5	14.2	9.4
	Cost of educational materials	17.4	10.3	13.9
	Attitude of girls to SMT subjects	18.4	11.2	14.8
	Religion	2.3	1.1	1.7
	Others	13.8	6.5	10.2
<b>Total</b>		<b>(N=99)</b>	<b>(N=96)</b>	<b>(N=195)</b>
<b>Mother</b>	Gender determines who choose SMT	5.6	9.1	7.4
	Financial constraints	24.7	33.5	29.1
	Early marriage	2.5	5.4	3.9
	Girls not interested in SMT	6.8	5.4	6.1
	SMT courses requires more time	10.1	15.7	12.9
	Others	11.1	8.3	9.7
	Don't know	39.2	22.6	30.9
<b>Total</b>		<b>(N=104)</b>	<b>(N=80)</b>	<b>(N=184)</b>
<b>Children</b>	Financial constraint	13.1	16.3	14.7
	Teachers attitude	7.7	9.5	8.6
	Parents refuse to change old ideas	6.4	14.8	10.6
	Lack of interest in SMT	14.1	5.1	9.6
	SMT too difficult to understand	6.5	6.2	6.4
	Gender determines who read SMT	8.4	7.9	8.2
	Others	19.2	24.5	21.9
	No reason/Don't know	24.6	15.7	20.2
<b>Total</b>		<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

from the existing literature. In African countries, economic, socio-cultural and religious factors have been highlighted. Poor infrastructure, the poor quality of education, and geographical factors are also considered significant. However, most studies have not examined whether these factors can also lead to disparity in the choice of subjects among boys and girls and the particular set of factors relevant to specific groups, which need to be manipulated through policy as well as the extent to which there are changes in these set of factors.

These causes of gender disparity resounded in this study but only differed slightly between the different groups of respondents. For instance, household heads tended to emphasize structural and cultural constraints to female participation in science, mathematics and technology (Table 2). In the two LGAs, the most frequently cited reasons given by household heads were financial constraints, cost of education materials, poor attitudes of government and parents to female participation in SMT, the negative attitude of girls and cost related factors in that order (Table 2).

The negative attitudes of girls to SMT were considered a major problem in Oriade LGA, whereas, the most frequently cited reason in Ifedayo LGA was the financial constraint and attitude of parents to female participation in SMT. The poor attitude of parents pro-

bably stemmed from the bias of the Islamic population in Ifedayo against female involvement in formal education and the choice of SMT courses in particular.

As far as the children were concerned, the causes of gender disparity in SMT were related to women's traditional roles and their personal attitudes, which may also stem from their religious orientation. This is apart from financial problem, which was emphasized in the two local government areas. In Ifedayo, a significant proportion of the children (14.8%) believed that parents' negative attitude towards female participation in science and technology education, in particular and education in general, was responsible (Table 3). This factor was not however emphasized by children in Oriade. Here, lack of interest in SMT by the female children was the important factor where 14.1% compared with only 5.1% in Ifedayo emphasized this factor. Teachers' attitude and the belief that gender determines who pursues SMT education were also mentioned by significant proportion of both male and female children (7.7 and 8.4% in Oriade and 9.5 and 7.9% respectively for male and female respondents in Ifedayo LGA).

The causes of disparity at the household level, as emphasized in the focus group discussions and in-depth interviews, were much more specific and were related to personal experiences and com-

**Table 3.** Percentage distribution of respondents by outcomes of gender disparity in SMT.

	Outcome	Local Government Area		
		Oriade	Ifedayo	Total
		(N=97)	(N=92)	(N=189)
<b>Household heads</b>	Men better placed in society	21.2	12.5	16.8
	Shortage of manpower	5.1	2.1	3.6
	Sex segregation in SMT	2.4	3.8	3.1
	Engenders hatred	6.4	4.1	5.2
	Underdevelopment	19.7	24.7	22.2
	Male dominance	9.5	10.6	10.1
	Others	32.2	25.0	28.6
	No problem	3.5	17.2	10.4
		<b>(N=99)</b>	<b>(N=96)</b>	<b>(N=195)</b>
<b>Mothers</b>	Hatred	12.4	6.2	9.3
	Female children are discouraged	19.2	22.6	20.9
	Public post controlled by men	15.9	11.2	13.6
	Women unemployment	17.1	9.4	13.2
	Underdevelopment/backwardness	14.8	7.3	11.1
	High drop out	6.4	7.1	6.7
	No problem	5.4	13.6	9.5
	Others	8.8	22.6	15.7
		<b>(N=104)</b>	<b>(N=80)</b>	<b>(N=184)</b>
<b>Children</b>	Lack of women in SMT-related jobs	22.1	17.6	19.9
	Female children are discouraged	19.4	16.2	17.8
	Public post controlled by men	7.6	9.5	8.5
	Women unemployment	9.1	8.4	8.7
	Underdevelopment/backwardness	21.6	13.7	17.6
	No problem	8.3	16.4	12.4
	Others	11.9	18.2	15.1
<b>Total</b>		<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

munity characteristics. Among the less literate and predominantly Islamic communities of Ifedayo, that “female education ends in marriage” was a major disincentive. Thus corroborating earlier findings that: “*it is more beneficial to formally educate a boy than a girl and that girls only need to be educated and trained in house chores to prepare them for marriage*” (FEMSA Report No. 9). Female education was also believed to be destabilizing as many educated women now agitate for change in traditional roles and decision-making process (FEMSA Report No.10). In this LGA, girls marry early and attend Islamic schools, which help to preserve traditional gender roles.

Mothers also presented a wider range of explanations. Financial constraint was the most emphasized factor in Ifedayo LGA followed by attitudinal factors. In Oriade, some women believed that girls were not really interested in SMT-related courses. In both LGAs, some women believed that women participation in SMT education was a waste. This perception stem from the erroneous belief that SMT courses take longer time to complete and girls, according to one participant in a focus group discussion have very limited time before marriage. “*It is like taking a big risk to allow girl-child to stay in school for so long. This is even more dangerous now that matured girls roam about the street without job and could even miss their chance of getting husbands*”. Another woman in Ifedayo said: “*Me, I rather encourage my girls to specialize in subjects that are simple and do not require longer time to complete*”.

### Problem associated with gender differential in SMT

The most frequently cited problems associated with gender disparity in SMT by household heads and mothers included: female under-development and backwardness, hatred and intra-familial squabbles, poverty, poorly motivated children, control of public post by men and unemployment of women. Among the problems identified by household heads are underdevelopment and backwardness, a culture of dependency on men by women; better placement of men in the society, poor training of offspring, and male dominance (Table 3). Household heads also agreed that gender disparity in science; mathematics and technology could have negative impact on familial relationship. For instance, about 5% believed that such disparity could engender misunderstanding among family members (especially between women who had only female children and those with male children) (Table 3).

As perceived by the mothers, gender differential in SMT engendered such problems as female underdevelopment and backwardness, hatred and intra family squabbles, high rate of school drop out especially among girls, poorly motivated children, unemployment of women and control of public post by men (Table 3).

Children were not aware of a wide range of problems created by gender disparity in SMT. The most important problems identified by the children were the poor access of women to highly paying jobs and the likelihood that girls would always occupy positions of less

value in the public posts compared to their male counterparts.

## DISCUSSION AND CONCLUSION

The emphasis on these factors differed a little between the two LGAs. Financial constraints mentioned in Ifedayo reflected its poverty and ignorance on the part of parents. Much emphasis was still placed on socio-cultural factors by household heads and mothers in Ifedayo where 14.2% of household heads indicated preference for boys' education. In the same vein, mothers in this local government highlighted such causes as: 'SMT courses require more time' (15.7%), 'gender determines who choose SMT' (9.1%) and 'early marriage' (5.4%). Parents in Oriade, a more developed LGA, are now shifting their emphasis away from socio-cultural factors that dominated explanations in Ifedayo. Our findings showed that poverty was an underlying factor, however, this was more than the poverty of infrastructure and social services.

The study confirms the claim by previous studies by Erinoshio (1994) and Kahle and Meece (1994) that females are underrepresented in SMT educational programmes as well as in related jobs. Although the situation differs from one society to the other and from one family to another, our social systems are generally skewed in favour of the boy-child because our societal norms perceived him as the future breadwinner and decision-maker, the one who was destined to carry the family name and lead the nation. Consequently, many families often neglected the development of the girl-child outside the family setting. Since there are no policies against gender balance in SMT activities and access to educational institutions enjoy reverse discrimination in favour of females, the constraints against parity in participation or performance in SMT are mainly socio-cultural, economic, and of teaching/learning process factors.

Our socialization processes inculcated gender biases through the different roles and responsibilities assigned to girls and boys. The most damaging effect of this differential treatment accorded to the sexes was the denigration of the so-called female's roles. Women were thus seen as nurturers and mainly as providing support for men who worked to provide for the family. Furthermore, the basic socialization process still presents marriage as an unequal relationship between men and women, while preference is still placed on the 'male child'. In such an unequal gender relationship, a woman's desire to improve herself through higher education and specialization in SMT subjects may be undermined by the husband in order to maintain the traditional power structure in the home. The girls are reported to be more affected by socio-cultural factors, which result in lateness, persistent absenteeism, poor performance and higher drop out rates. Although the socio-cultural constraints vary in content and scope across the country, to a great extent they determine the attitude of families and society towards science and technology education. The study reinforced the

points raised in previous researches (Erinoshio, 1994) that both boys and girls participation in SMT education is constrained by gender roles and expectations. These include domestic chores, perceptions of communities towards education of boys and girls, and the relative opportunity cost of sending children to school. Education is thought to be more beneficial in preparing girls for their roles as mothers and wives rather than for employment (Burchfield and Kadzamira, 1996).

In the face of economic recession, inflation, unemployment and poverty, it is not uncommon for poor families to give preference to boys' participation in SMT because the returns on boys' participation are assumed to be more beneficial than those of the girls.

Findings from our focus groups discussions show that boys, generally, think more of professions that will yield money to enable them marry and maintain a home. So professions like medicine, engineering, business, banking and finance are highly favoured by them. On the other hand, society expects females to play a supporting role when it comes to maintenance of families. Unfortunately, many men now find it difficult to perform this role for various reasons ranging from poor remuneration if in employment, to poor revenue generation if self-employed. In many homes, women are faced with the task of becoming the breadwinner due to economic crunch. Therefore, there is urgent need for change of attitude towards gender fairness and encouragement of gender balance in all endeavours so that women can be well prepared for such roles in future. Serious economic problems do arise when widows are faced with the problem of bringing up the young one. Women, therefore, need to be properly empowered to handle such responsibilities in life if and when the need arises.

In order to stem problems arising from gender differentials in SMT, the actions taken so far, that led to noticeable trend of improvement in female participation in education over the years are to be continued; and more affirmative actions embarked upon to encourage their participation in SMT. On the basis of this, some suggestions are hereby proffered which are capable of boosting female participation in SMT both in terms of quantity and quality

High level of community participation and parental involvement has been shown to lead to positive outcomes in science and technology. It is evident from the survey that parental involvement in school administration and in the children education is minimal. The linkages between the school, parents and teachers associations (PTA) and parents should be reviewed with the aim of enhancing the role each of them plays in SMT education.

As suggested in some studies, this can be achieved through what is called 'open days' where parents are invited to see what happens in schools. Parental behavioural expectations for their daughters have important implications for females' interest and achievement in science and mathematics. Parents have the greatest potential to

influence their children.

Though a lot of grounds have been covered by FAWE and some other organization in community sensitization and mobilization through such programmes as out-of-school activities in some African countries, creation of FAWE Centre of Excellence and FAWE Resident Guest Researcher Programme (FRRGP), a package of communication strategies such as participatory drama, focus group discussions, radio and other media could be used to sensitize people on the need for girls to be actively involved in SMT education.

Finally, to address the imbalances in females' access to SMT, there is need to implement some measures of fair discrimination or equitable redress in favour of those who are normally subjected to greater disadvantage by society. Teachers are not aware of gender problems in their classrooms (Brummelhuis, 1994). Teachers and the educational system have the ability to shape the self-image and future of girls as they approach SMT fields. A key issue in overcoming gender inequities as recognized by Gunn (1994), therefore, is that the teachers themselves need to be aware of the issues and how to address them. Workshop and in-service programmes are the best avenue to increase teacher awareness of gender issues and their ramifications.

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