LOW PARTICIPATION OF FEMALE GENDER IN SCIENCE AND TECHNOLOGY: CAUSES AND WAY FORWARD

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ABSTRACT

Low participation of females in Science and Technology among their male counterparts for national development has been a cause of concern in Nigeria. This paper proposed the causes for low turnout and the way forward for more impactful science and technology advancement in Nigeria. Quantitative research method was adopted to properly analyze and give a clear picture of the study. Structured Questionnaire on a five point Likert scale was administered purposively to a sample of 300 female students in the school of management studies, Federal Polytechnic, Ilaro, Ogun State. Analysis was done using descriptive and inferential approach. Results of empirical analysis indicates that peer group influence, discouraging school curriculum, culture of marginalization and poor foundation in mathematics, were found to be the major impediments to female gender low participation in Science and Technology as evidenced from the factor loadings. The identified variables were calibrated for model development using OLS approach for test of significance as respective 36%, 17.6%, and 17.1% on PGI, DSC, and PFM directly influenced female gender low participation. Significance of the model was tested using student "t" approach and were also found to be significant based on their respective p-values (0.000, 0.002, and 0.021) < α=0.05 significance level. Empirical analysis of the research study suggests that use of ICT in teaching of science and technology based courses in schools, giving career talks by successful female in Science and Technology fields and provision of gender equality in terms of job placement will increase female gender participation for technological advancement in Nigeria.

Keywords: Science and Technology, Socialization Weighted Average, Cognitive Ability, Factor Loadings

1. INTRODUCTION

Participating in Science and Technology education is important to support female genders role as users and innovators of technologies as well as researchers, scientists and technologists. Female gender has long been underrepresented in Science and Technology education and employment, and much has been done to understand the causes and identify Gender equality is fundamental to achieving poverty reduction and socio-economic development: this results from the central and vital role that women play in society through their contribution to productive activities and their role as social educators and family caretakers. Low participation is problematic not only from a rights point of view, but also from an economic angle.

According to United Nations Division for the Advancement of Women (DAW), in an era where economic growth is often linked to a country's capacity for innovation, women's contributions become especially important. Women help diversify research and development teams, bringing different points of view that can fuel creativity and result in better quality outputs. For example, in 2007, American IT patents produced by mixed-sex teams had higher citation rates than those produced by male-only or female-only teams. (DAW)
Due to problems in attracting and retaining girls and women in science and technology there are fewer women at every career step in this field. The lack of female role models and issues related to work life balance are other factors that may hold back girls and women in choosing and staying in Science and Technology. Some even believe that role of a women is for childrearing and taking care of the family. Therefore, their participation in science and technology is not family friendly. At the same time, gender equity in science and technology is important for development, as long has been recognized by the United Nations (UNCTAD 2011). Mainstreaming a gender perspective in Science, Technology and Innovation (STI) will both enhance social equity and bring significant benefits across the economic structure and social fabric, and contribute to the achievement of the Millennium Development Goals and the attainment of sustainable development.

2. LITERATURE REVIEW

In a study on Gender Bias in mathematics, science and technology (Strauss, 2002), found that the absence of equitable elementary and middle school science instruction that includes hands-on activities is a serious form of discrimination in the educational system. Similarly, Croxford, (2002) observed that one of the reasons why young people, particularly females, opt out of science and technology is due largely to their perception. In a similar vein, Aguele, (2004) observed that the negative image of women towards STM has accounted largely for the low enrolment of females in these subjects particularly in the universities. He observed further that enrolment ratio of males to females in STM for the academic years 1993/94,1995/96,1996/97 and 1997/98 in some Nigerian Universities stood at 6:1, 3:1,3:2 and 3:1 respectively.

Suter, (2006) points out that woman prefer careers that do not conflict with family responsibilities and are useful in childrearing, such as education, psychology, or medicine. Therefore, it seems that women do not consider ST Fields to be family-friendly (OECD, 2008). In addition, Xie,(2006) finds that it may be harder to combine family and work in some fields (e.g., those that demand many lab hours) than in other fields (e.g. Social sciences). Other authors note that women are drawn to fields that are more related to people than to numbers (OECD, 2008; Baker and Leary, 1995; Ceci and Williams, 2011).The family background and the absence of female role models can also influence women's participation in ST careers (OECD 2008; Suter, 2006; Xie, 2006). argues that young people make career choices on the basis of adult workers' experiences. When women become

Successful in a field, the next generation is more likely to emulate their success. In addition, a woman's family could influence her selection of a field of study. Suter ,(2006) states that female students in engineering and other branches of science often have at least one parent with a profession in one of these disciplines. This clearly points to the importance of having a female role model working in a male-dominated profession or field of study.

Coombs (cited in Aguele and Uhumuavbi,2003) observed that gender differentials in enrolment and achievement in higher education is invariably rooted in inequality at the primary and secondary levels where the real sorting out of University bound students take place. According to Coombs, female participation and interest in STM diminishes as they move up in the educational ladder towards the university level due to a variety of factors that are primarily rooted in their religious and cultural beliefs surrounding the role of women in the society.

Research findings have indicated that gender differentials in higher education are invariably rooted in inequalities at the primary, and secondary levels where the real sorting out of university bound students takes place (Coombs, as cited in Aguele and Uhumuavbi, 2003). These inequalities includes traditional and religious beliefs, remoteness, poverty, child labor, social roles required for the different sexes, argument about biological built up of women and birth order. Some other factors that have been identified (Okeke, 1990; Obodo, 1993; Ifeluni. 1997) include lack of support from education policy makers, different socialization patterns for boys and girls at early stages of life, early marriages, and teachers 'attitude to girls. It is a known fact in Africa that women used to be denied and deprived of many benefits (social and economical) which their male counterparts enjoyed. Such deprivation has also affected the status of girls and women in the society. The extent to which such deprivation has modified their mental Science, Technology and Mathematics (STM) are today known to be very central to the development of any nation. (Ukeje,(1997) observes that the development of a nation is properly accessed by the level of the education of its citizens in STM. Uhlig,(1999) also alluded to this view when he stated that: In the theory and policy of development it has been accepted from the beginning of the debate that one of the essential pre conditions for the development and transformation of a national economy is the factor of education in the broadest sense and science and technology in the particular sense. The implication of this is that to attain national development, it is not enough to educate the citizens in the broadest sense, but to give them sufficient education in Science and technology. This is so because Science and technology is considered as the vehicle for rapid development and economic transformation of a nation. Today, women constitute more than half of the world's population (Commonwealth1999). Hence, we cannot afford to ignore them if we must attain meaningful development in our nation. Capacity may never be fully explicated (Aguele, 2004).

3. MATERIALS AND METHODS

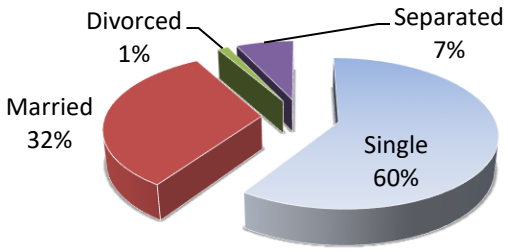
Data Collection Method

Primary method of data collection was adopted in carrying out this research study. The surveyed data used was collected through structured questionnaire. The questionnaire was administered purposively to a sample of 300 female students in the school of management studies, Federal Polytechnic, Ilaro in order to know the causative factors and solution of low female gender participation in science and Technology based and career.

Method of Data Analysis

Descriptive and inferential Statistics method of data analysis was applied to scaled statements to examine the order of importance. Pictorial representation of scaled statements was done using bar chart. Factor analysis was adopted to extract the most prevalent impediments to low female participation in science and technology, thereby fitting Ordinary least square model to those important variables for test of significance.

4. Results and Discussion



Distribution of participants marital status showed that majority of them are single which accounts for 60% of the total sample selected, while 1% are the divorced depicting the minority. The married and separated participants were 32% and 7% of the total sample respectively.

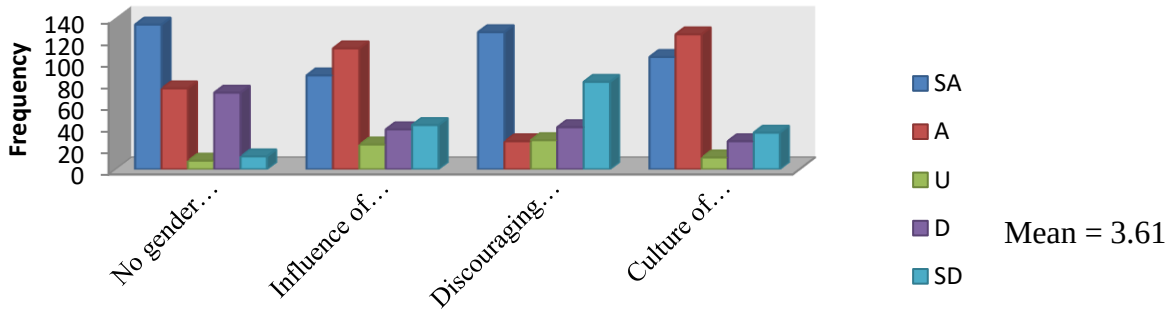
Fig. 1: Distribution of participants Marital Status

Table 1: Perception of Participants on Female Gender Participation in ST

S/N	ITEMS	SA	A	U	D	SD	WF	WA	Decision
1	There is low turnout of female students in science and technology courses in tertiary institutions	99	126	16	33	26	1139	3.80	A
2	There are challenges faced by females in science and Technology opportunities compared to their male counterpart.	103	100	11	28	58	1062	3.54	A

Results presented as number of participants. Perception was scored by assigning 1 to SD, 2 to D, 3 to U, 4 to A, and 5 to SA. Reversed questions were coded otherwise.
Source: *Researcher's Self Computation*

Perception of participants on female gender participants in science and technology can be depicted in table 1. Item one showed that participants Opined that female's turnout in science and technology is low due to the challenges faced by in Science and Technology opportunities compared to their male counterparts



Socialization as an impediments to low female gender participation in ST.

Fig. II: Multiple Bar Charts showing Distribution of Participants on Socialization as impediments to low female gender participation

Mean of 3.64 in figure 2 indicates that socialization such as gender inequality, influence of peer groups, discouraging school curriculum, and culture of marginalization is an impediments to low female gender participation in Science and Technology.

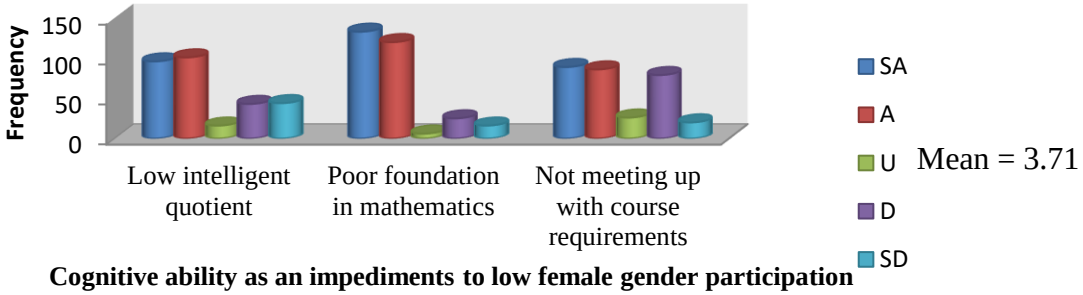


Fig. III: Multiple Bar Charts showing Distribution of Participants on Cognitive Ability as impediments to low female gender participation

Pictorial representation of figure III showed that majority of the respondents agreed on a weighed score of 3.71 that cognitive ability of female participants taking low intelligent quotient, poor foundation in mathematics, and not meting up with course requirements into consideration impede low female participation in science and technology.

Table 11: Impediments to Female Participation in Science and Technology Based on factor loadings

Component	Initial Eigenvalues			Communalities	
	Total	% of Variance	Cumulative %	Variables	Extraction
1	1.702	24.318	24.318	PGI	0.866
2	1.407	20.098	44.415	DSC	0.827
3	1.125	16.064	60.480	COM	0.811
4	1.019	14.554	75.034	PFM	0.733
5	.718	10.253	85.287	NGE	0.728
6	.569	8.131	93.417	LIQ	0.691
7	.461	6.583	100.000	NMCR	0.597

PGI = Peer Group Influence; DSC = Discouraging School Curriculum;
GE=No Gender Equality; NMCR=Not meeting up with course requirements
PFM = Poor foundation in mathematics; COM=Culture of Marginalization;
LIQ=Low Intelligent Quotient

Factor loadings of table II showed that out of the seven factors contributing to low female participations in Science and Technology, only four were of high importance based on the initial eigen values >1 and higher extracted communalities of 0.866, 0.827, 0.811, and 0.733 for factors of Peer Group Influence, Discouraging School Curriculum, Culture of Marginalization and Poor Foundation in Mathematics which contribute to 75.03% of the total percentage variance.

Generally we are interested in keeping only those principal components with Eigen values greater than one based on significance of Kaiser Criterion (Kaiser, 1960). Other factors such as; "No Gender Equality", "Low Intelligent Quotient", and "Not meeting up with Course requirements" were found also found to be fundamental structure of barriers but contributed to only 24.96% to the menace under study .
The extracted impediments were used to confirm the significant their effects of female gender interest on science and technology as evidenced from table 2.

Table III: Regression Analysis

Model	Coefficients		t-stat.	P-value
	B	Std. Error		
(Constant)	1.439	.422	3.411	.001

PGI	.360	.047	7.693	.000
DSC	.176	.057	3.089	.002
COM	-.078	.066	-1.181	.239
PFM	.171	.074	2.313	.021

R = 0.789**;** **R^2** = 0.623**;** **Adj. R^2**= 0.619**;** **F-statistic** = 23.135 **(P-value** = 0.000**);**
Dependent: Low Participation (LP)
***Source**: Extracted from SPSS, Version 20.*

The model specification of table 3 is written as:

$$LP = \beta_0 + \beta_1(PGI) + \beta_2(DSC) + \beta_3(COM) + \beta_4(PFM) + \varepsilon_i \quad (1)$$

Where:

$$LP = 1.439 + 0.360(PGI) + 0.176(DSC) - 0.078(COM) + 1.71(PFM) \quad (2)$$

The model specified from table 3 above is given by equation (1) with the substituted coefficients in equation (2). This model gives a reasonable projection of low participation in science and technology for a unit increase in "Peer Group Influence", "Discouraging School Curriculum", and "Poor Foundation in Mathematics", which is statistically significant based on the computed 't'(7.693, 3.089, 2.313) values. In fact, the relationships exhibited by the predictor measure of "Low Participation" is in line with prior expectations as analyzed impediments are expected to have impacted positively as exhibited in the estimates. However, its coefficient of determination ($R^2 = 0.623$) implies that 62.3% of the variation in measure of female gender "Low participation in science and technology is accounted for by PG1, DSC, COM and PFM respectively. This model also clearly shows that the model is adjudged a best fit as confirmed from the F=23.135 (df = 4, 294) P-value < 0.05 significance value. In addition, coefficient of "Culture of Marginalization" (-0.078) does not contribute significantly (t = -1.181, P-value > α = 0.05 level of significance) to the model. The non-significance of the coefficient might be as a result of the opinion raised by the respondents' on whether culture of marginalization is an impediment or not and was also negatively inclined. This resulted on the fact that opinion raised on culture of marginalization varies from participants to participants taking the area from which the study was conducted into consideration.

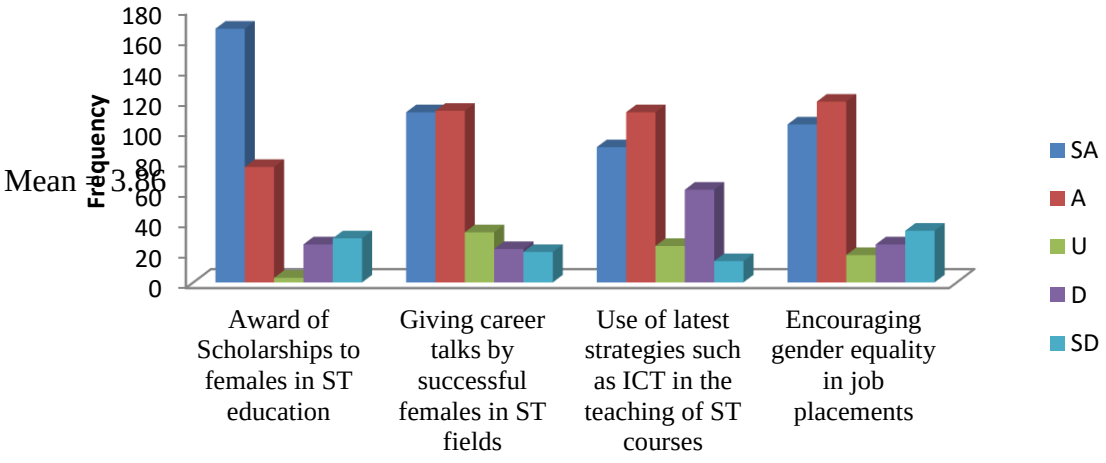


Fig IV: Multiple Bar Charts showing Distribution of Participants on solution to turnout of female gender in Science and Technology

However, empirical analysis of this research study indicates that awards of scholarships to females in Science Technology education to motivate others, giving career talks by successful females in Science and Technology fields, use of latest strategies such as ICT in the teaching of Science and Technology courses and encouraging gender equality in job placements as opined by the respondents in figure 4 will alleviate the low turnout of females in Science and Technology as this will increase the image of technology advancement in Nigeria.

5. CONCLUSION

The result of the study suggests that Peer Group Influence, Discouraging School Curriculum, Culture of Marginalization and Poor Foundation in Mathematics are issues in the participation of female genders in Science and Technology Education. The motivating factors for the increase of female genders from the respondents was awards of scholarship to females in Science and Technology education to motivate others, giving career talks by successful Females in Science and Technology fields, use of latest strategies such as ICT in teaching of Science and Technology courses and encouraging gender equality in job placements will alleviate the low turnout of females in Science and Technology as this will increase the image of technology advancement in Nigeria. The study recommends that the society should be enlightened on the need to change attitude to gender roles.

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