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WOMEN, YOUTH, CULTURE AND DEVELOPMENT IN AFRICA

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Chapter 7

Beyond Bias and Barriers: Fulfilling the Potentials of Women in Science

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Introduction

Issues relating to girl-child education have been topical in the last few decades. This can be ascribed to the call for improved representation of girls in education. Girl-child education plays a pivotal role in the development of a nation. The education of the girl-child is a strategic development investment. The aphorism holds true that 'when you educate a boy, you have educated a human being but when you educate a girl, you have educated several nations'. Evidence shows that countries with equality in gender participation and involvement in science are more likely to have higher economic growth (Pollitzer, 2011).

The girl-child has been particularly disadvantaged in Science, Technology, Mathematics and Engineering (STME). Girls do not have equal opportunity to education in STME as boys (Miyake &Kost-Smith, 2010). Masculine dogma, educational bias and prejudices steer girls towards arts and humanities (Ezirim, 2006). The persistence of low representations of girls in science-based courses undermines the intensity of efforts dissipated at narrowing the gulf. A range of initiatives has continuously been set up to promote science among girls, and to support those women already working. It is worrisome to still observe a gloomy picture of improved participation of girls in STME.

There is a persistent and well-documented pattern of under-representation of women working within the fields of science-related careers. Akalanu (2006) noted over concentration of women in less prestigious and less rewarded scientific occupations. This situation has invited renewed vigour at unearthening the clog in the wheel of progress of girls' participation in STME. It is desirable to focus searchlight on this burning issue with a view to critically appraising the situation and proffering practicable suggestions towards improved participation of girls in STME. To achieve this, this chapter discusses nature and nurture controversy, identifies the barriers to girls' participation in STME, and proffers strategies for bridging the gulf in girls' participation in STME.

Nature Versus Nurture

This argument is based on the premise that females are biologically limited and restricted in their understanding of STME (Esiobu, 2005). Nature refers to the genetic component of an individual while nurture is the environment. Behaviour is determined mainly by genetic inheritance (nature) or by environmental factors (nurture). Intellectual endowment is not a function of sex. Intelligence, as an entity has normal distribution in the population and has shown no gender discrimination (Esiobu,2005). It has been established that girls have the same intellectual capacity for STME as boys. If environment does not play a part in determining an individual's traits and behaviour, then identical twins should theoretically, be exactly the same in their way of life.

Barriers to under-representation of girls in STME

Under-representation of girls in STME disciplines are historical and are brought about by strings of inter-related socio-cultural and interacting school factors. These factors act singly and jointly to affect girls participation in STME. Research is replete with the barriers which can be categorised into two: home factor and the school factor. The

home factor includes parental preference for education of the girl-child; gender role stereotyping and gender stereotyping in career choices while the school factor includes gender bias in curriculum materials and instructional strategies and teacher disposition. It may be necessary to explicate these factors with a view to gaining proper understanding of their crippling effects.

Parental preference for education of the boy child: Evidence abound (Opara,2006; Nwosu, 2006 & Akalanu,2006) showing parental preference to the education of the girl-child in Nigeria. Several years back, a boy child is preferred because he is seen as one that will hold forth for the parents after death whereas a girl-child will leave the home front by getting married. The boy child inherits the property and propagates the family name. A family without a boy child is considered to have perished. It is believed that having a boy child is a more profitable investment on the family lineage as he helps in farm and handcrafts. On the other hand, it is believed that a girl-child will end her education possibly in the kitchen. There is a slight change in this notion now as a girl-child has improved access to education. It is common knowledge that medical and biological sciences are attracting more women but physical sciences, engineering and technology remain male dominated fields of study and employment globally (Peterson,2013).

Gender role stereotyping: Societal expectations of the role of a boy-child differ significantly from the role of a girl-child. In traditional African setting, young children are raised in conformity with expected roles. It is not surprising to see parents provide ball and car toys for a boy and baby doll for the girl. On household chores, boys are asked to wash cars and cut grass while girls are restricted to washing of clothes, cooking and hairdressing.

Gender stereotyping in career choice: The choice of a career is influenced very greatly by sex. Girls are seen to concentrate their choice of professions on a small variety of occupations such as

hairdressing, sewing, catering, nursing and teaching (physical science subjects excluded). Boys predominantly opt for professions like carpentry, bricklaying and engineering.

Gender imbalance in the textbooks: There is preponderance of masculine image in illustrations, pictures and activities contained in science textbooks (Owolabi & Onafowokan, 2001). These undoubtedly paint a masculine image for STME and discourage many females who may aspire to study STME courses. In situations where female illustrations are available, they tend to represent females in less tasking activities thereby giving an erroneous impression of being weak creatures (Owolabi & Onafowokan, 2001). Also, sex-biased phrases and expressions in textbooks could steer away girls from STME (Njoku, 2006).

Instructional strategies: Science is activity oriented and activity driven. Research findings have supported activity-based teaching which presupposes that science teachers deploy practical activities which predominantly involve doing. As noted by Nwosu (2006), in a study of the effect of sensitisation programme on students acquisition of process skills, findings showed that the instructional process rather than sex and biological differences played the most important role in determining the extent of participation by both male and female in science. A number of studies e.g. Erinosho (1994) confirmed that girls are rendered dormant when assigned passive role like note-taking and recording of observations whereas boys are involved in actual doing of the experiments. Also, gender differences in communication styles in the classroom do occur as boys tend to respond to questions more confidently and quickly than girls (Busari, 2005). Some teachers assist female students out of sympathy while giving more challenging tasks to male students (Busari, 2005).

Intervention programmes have been mounted in several parts of the world with the aim of narrowing the gap in participation of boys and girls in STME. The following practical steps will further add to existing literature on how to fall the barriers to gender participation in STME.

De-sexing STME curricula: This involves expunging all forms of gender biases in previous editions of textbooks and curricula. It implies that gender balancing is achieved in terms of language of expression, illustrative diagrams and learning activities. Girl-friendly curricula and textual materials may include the preponderance of use of pictures showing girls in science activities. A cursory look at existing situation showed a remarkable improvement in the present curricula in use in Nigerian school system. The contents of most curricula and textual materials in STME have to a large extent reflected gender inclusiveness. Co-curricula activities such as organisation of science and technology clubs, Information and Communication Technology forum with female students and teachers playing prominent roles will help develop female students' interest in, and positive attitudes towards science and technology.

Adoption of gender-inclusive classroom instruction: This entails having a classroom where STME instruction and learning activities are female friendly. This is achieved by avoiding comments, jokes, innuendoes, covert or overt behaviour capable of triggering aversion, attrition and inferiority complex. Creating a level playing field for all learners will ginger their interest and confidence. That is, sustaining a democratic classroom environment that provides students the opportunity to freely air their views, ask questions and participate very actively in learning activities, is inevitable. Flurry of research reviewed focused on cooperative, activity-oriented and participatory teaching. Competitive interaction patterns have been found to depress achievement of girls in science (Okebukola,1985). To achieve

gender-balanced instruction in the classroom. Nwosu (2006) advocated the use of constructivism because it is interactive and allows students to construct their own views of concepts being taught. Also, girls tend to have success with real-life application problems as well as with questions relating to process skills (Busari, 2005). In mixed sex schools, roles have to be rotated to allow every student opportunity to exhibit competence (Baker, 1996) while in single-sex schools, small groups have proved to be beneficial to girls (Esiobu,2005).

Non-stereotyping of gender roles: Considering the roles given to a girl-child at home which affect their achievement in science and technology related subjects, developing self-pacing individualised software for learning in STME will invariably help close the gender divide gap in students' achievement.

Sensitisation of parents on gender stereotyping: Parents and guardians need to be sensitised on gender fairness in assigning roles to children. They should allow boys and girls to perform tasks rather interchangeably, and allow free choice of career without bias. At the society level, efforts are needed to ensure access to less educated and illiterate people by developing appropriate software applications and content which can run on common ICT gadgets available and affordable by this category of persons. Research has shown that parental attitude and support greatly influence girls' participation, and success level in science and technology. This attitude can be moderated within the community by organising advocacy programmes with speakers who are achievers in science and technology to address women at the community level, and exhibit inventions/achievements of science and technology. Advertisement of science and technology products in various media should be gender friendly to help nurture parents' attitude towards science.

The use of role models: Female professionals who have distinguished themselves in STME should be role model to the young girls. The

pictures of such role models should be rendered as posters and distributed to schools. Such role models should be invited to give talk to students during important occasions. The efficacy of this strategy in motivating and inspiring girls was ascertained by Brown (1991). Modelling of positive attitude towards science and technology could be achieved through a number of ways including the following: developing teaching/learning materials such as textbook illustration, charts and video clips showing females carrying out significant roles, disseminating and deploying science and technology in finding solutions to societal problems. Such materials will also help strengthen cultural understanding, if the female icons used identify with various socio-cultural groups in the country, or if the students can identify them within the society.

Government incentives: Government can help develop the society through policy formulation and implementation to encourage active participation of females in science and technology. GSM telephony is spreading fast into the rural areas. The GSM providers are already building in local languages into their customer services and products promotion, therefore government can seize this opportunity to develop interest and positive attitudes to science and technology in every locality. Also, access to ICT products and services in the rural areas should be subsidised by government to enable them tap the opportunities provided by these technologies in ensuring sustaining development of the country. Related operating infrastructure for utilising products of science and technology should be provided by government to ensure unrestricted access to global information on developments in science and technology.

Conclusion

This chapter attempts an in-depth analysis of barriers to gender equality in STME. It identified the sources of the barriers and proffered practicable solutions. The goal of scientific and technology literacy for all should be resolutely pursued in the light of increasing

dependency on the products and processes of science in today's world. Men as well as women should be equally served and hence steps should be taken to address the gender inequality to the disadvantage of women and girls which is currently reported globally. The statistics are more unfavourable for Africa. Therefore, African countries that are desirous of extending the benefits of the good life which science and technology guarantee should adopt measures for bridging the gap. Suggestions have been made in this chapter which can be customised for local settings.

It is gladdening to see islands of success stories in Africa on how gender gaps in participation and performance in STME are being bridged. These are still mere specks in the wider horizon of the continent. In the forthcoming years, it is hoped that more of these stories will be recorded and all men and womenfolk in Africa will achieve the lofty goal of science and technology literacy.

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