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Enhancing Woman Empowerment through Science, Technology and Mathematics Education for National Development

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Abstract

The role of science, technology and mathematics in women empowerment and national development cannot be over emphasized. Hence this paper focuses on women empowerment through the use of science, technology and mathematics for national development. It addresses the problem of STME in Nigeria, ranging from lack of resources/ facilities, lack of materials in the laboratories, qualified STME teachers and their method of teaching. The issue of low female participation in STME has become a concern both in Nigeria and in the global world. The paper goes on to divulge the effect of gender indifference in STME on the society, women empowerment, national development and the rationale for women empowerment. Finally, the problems of women empowerment in Nigeria were discussed and recommendation of the paper on STME as panacea for women empowerment and national development were made among such recommendations are programmes that provides students an opportunity to engage in hands-on activities, life project, would be successful in increasing female enrolment and participation in STME. Some of the programmes include soap production, pomade making and dying of clothes e.t.c

Keywords: Women Empowerment, Science, Technology, Mathematics Education, and National Development.

Introduction

For any nation to develop, the study of science, technology and mathematics education (STME) should be given to the various levels of her education. Nigeria as a developing nation appears to have been prepared to solve the issue of development in science, technology and mathematics through her policy on education. The policy provide for a 60:40 admission ratio in the tertiary institution in favour of science, technology and mathematics (Federal Republic of Nigeria, 2014) indicated by the efforts in this direction appear to be yielding dividends as indicated by the admission ratio of arts to science of 26:71, 34:66 and 33:69 for 2016/17, 2017/18, 2018/19, academic years respectively (Aguele & Uhumuavbi, 2019) this is an improvement over what it used to be in the past where the ratio was in favour of arts related subjects.

Science, Technology and Mathematics Education (STME) have been called a Mega discipline, the creation of a discipline based on the integrated to other disciplinary knowledge into a new 'whole'. This interdisciplinary knowledge bridging among discrete discipline is now treated as an entity known as STM Education (moriton,2020) "STM holistically, rather than in bits and process. STM removes the traditional barriers erected between the four disciplines, by integrating them into one cohesive teaching and learning paradigm. However, the problem that seems to linger for quite sometimes now is the questions of female participation in sciences, technology and mathematics and related subjects. This has become a source of worry as it is difficult in the present day society to address the issue of national development without recourse to gender factor. Over the years, women limited participation in science, technology and mathematics course in tertiary institutions have been a course of concerned in Nigeria.

Science, Technology, and Mathematics Education in Nigeria

Orifor (2022) argued that science technology and mathematics education in Nigeria are grossely characterize inadequacy of content and ineffective methodology by teacher, paucity of facility, equipment and materials in our laboratories, as well as dominated socio-cultural lapses. The present trend of mass unemployment in Nigeria shows that the STME been taught in school do not prepare Nigeria graduates to function well in the nation undergoing transition from rural economy to modern economy (Nwachukwu, 2023). The courses which will be taught as hands-on and minds-on practical course as basically taught theoretically, this makes the learner not to benefit maximally from the education. Hence, development of useful skills necessary for self reliant living is lacking.

Nwachukwu (2023) enumerated some of the problem confronting STME in Nigeria to include; lack of funds to purchase equipment/material, lack of adequate textbooks, overcrowded classroom/laboratories, poor timetable, lack of cooperation among administration, the pressure of external certificate examination. Other challenges include lack of proper monitoring and feedback mechanism. Poor preparation of teacher who teach the programmes, lack of motivation among teachers, the rapid rate at which teachers are transfered from one school to another or out of the profession and the use of traditional methods of teaching which ultimately hinder internalization of learned materials.

Abuh 2016 listed some of the problem facing STME in Nigeria to include the absence of effort to bring about meaningful self-reliance programmes and project to the community. There is lack of planning in different sector of Nigeria economy: including poor implementation procedures, shortage of qualify STME teachers, overwhelming number of activities demanded by the new curricula. Other problems include lack of clear cut goals, scarcity of resources and non-usage of research reports on the performance of the programmes.

Female participation in STME

It is the common knowledge today that university enrolment in STME appears favour the males more than the female. The table below gives the university enrolment for twelve states of Nigeria in the science and technology for academic years 2018/19, 2019/2020, 2020/2021/2022 2022/23, 2023/2024

	Technology	**Science**		**Total**		
	Male	Female	Male	Female	Male	Female
2018/2019	4830	1011	4000	1900	8830	2911
2019/2020	7800	1500	6800	3500	14600	5000
2020/2021	8468	1400	9460	3924	17928	5324
2021/2022	10180	3018	12521	4750	22701	7768
2022/2023	10290	3220	13611	4995	29851	7989
2023/2024	14384	4032	18416	20659	9643	30302

Source: federal office of statistics 2024 extracts

The enrolment for the six academic sessions gives a clear picture of female participation in STME in Nigeria universities for the period. This situation agrees with the finding of Aguele and Uhumuavbi (2019) that significant differences exist between male and female enrolment in STME in Nigeria universities. Female participation interest in STME diminished as they move up the educational ladder toward the university level due to the variety of factors that are primarily rooted in their religions and cultural beliefs surrounding the role of women in the society.

The issues of low female participation in STME seem to be a global problem. Billing (2023) observed that in the United Kingdom females make up only 18% of computer science and 11% of software and engineering in 1996 in USA universities, in 2024-2015 accounted for only 17% undergraduate science majors According to Billing (

2025), the deleterious trend was repeated in New Zealand with women accounting for mere 20% of undergraduate in information and science.

Not only are enrolments low and declining, but proportionately more women than men drop out, fails courses or choose to major in another subject other than science (Aguela & Agwagah 2022) what therefore are the likely causes of this gender difference in participation in STME. Participation. These ranges from societal, religious and psychological to attitude and interest level of students. Oriafor (2022) identified the following factors as being responsible for participation of females in STME.

1. Attitudes and expectations of parents and teachers
2. Instructional strategies such as hands-on experiences, group projects, field trip and interactions with role models as opposed to traditional textbooks method.
3. Curriculum materials that perpetuate the stereotype of the white male scientist and ignore the contributions of minorities and female scientists.
4. Involvement in out-school science activities
5. Portrayal of scientist in media as males.
6. Tracking or ability- grouped assignments.
7. Self-image and expectation that often change from high interest and low anxiety about science and mathematics in the lower classes of avoidance in the classes.

Effects of Gender Differential in STME on the Society

Science, technology and mathematics (STME) are today very essential to the development of any society. It constitutes both the foundation of wealth and development as well as the basis for classifying of a nation is properly accessed by the level of the education of its citizen in STME. STME is considered the vehicle for rapid development and economic transformation of any society.

Worthy of consideration is the extent to which all citizens are mobilized in the development effort. Interest in gender and participation in STME arise from "students." Unhampered by discrimination and the shortage of female representation in certain field of education, particular in scientific and technical areas. Today, women constitute more than half of the world's population (common wealth, 2016). Hence we cannot afford to ignore them 9if we must attain meaningful development in our society.

Access to STME can level the playing field for all social groups, equalizing connections between women and men, rich and poor and different group. There is the possibility therefore, that continued inequalities, with regard to participation in STME will in the future create barriers between males and females in both the home and work place (Aguele & Agwagah, 2022)

Women who are excluded from STME will limit their earning power and employment prospect and may continue to languish in stereotyped occupations. It is indeed clear that women without STME will be seriously disadvantage in the world of work to the detriment of the society in general. Of paramount importance is the inclusion of women's voices, experiences and perspectives in technological world to strengthen organization life, research and the future of humanity.

The ability of women to control their own health is absolutely fundamental to their empowerment and quality. When a woman can plan for her family, she can be more productive. Reproductive health problems including maternal mortality and morbidity represent a major but preventable cause of death and disability women in developing countries. Lack of STME to help women protect their productive therefore constitutes a problem to women and the society.

Women in developing countries are usually in charge of securing water for domestic use, fuel to cooking and cooking food. STME is relevant of maintaining simple hygiene in the home during food preparation and preserving the environment and natural resources. Lack of STME in women will cause them to mismanage the natural resources and endowed by nature.

The education of parent is linked to their children's educational attainment, and the mother education is usually more influential than the father's. An educated mother's greater influence in house hold negotiations may allow her to secure more resources for her children. STM educated mothers are likely to be in the labor force, allowing them to pay some of the costs of schooling and maybe more aware of returns to schooling they will bear fewer children and concentrate more attention on each child.

Women Empowerment and its Rationale

The questions surrounding women's empowerment, condition and position of women have now become critical to the human rights based approaches to development. The Cairo conference in 2014 organized by United Nations (UN) on population and development programmes (UNDP) developed the Gender Empowerment (GEM) which focused on the three variables that reflect women's participation in society-political power or decision making, education and health.

The need for empowerment arises from the inablility of individual potentials due to artificial berries created by individuals and other groups within the same society. It is the manifestation of an incontrovertible inequality segregation or marginalization. Okeke (2015) submitted that "to empower means to give power to, to give authority to, to enable a person or a group of person gain power."

The rationale for women empowerment was as the result of oppression of women by men which has been a major global dilemma and a source of concern to many international institutions like ECOWAS, UN, AU etc. the concept of empowerment based on assuaging the oppression of women has led to the establishment of the united Nations development fund for women (UNIFEM) whose primary role is to promote the participation of women at all levels of development, planning and implementation.

The Status of Nigerian women in STME in Tertiary Institutions/Universities

The status of Nigerian Women has been viewed differently in social relations including economic activities. This has formed a barrier even when domestic movement has sought to extend to the base of participation of women.

Illiteracy remains at the centre of women's problems in Nigerian. Majority of the women folk and a large number of girls in Nigeria are still grapping with the problems of basic reading and writing skills. (UNICEF 2017 indicate that 71% of our of school children and girls. The human development program (HDP) puts the statistics of

illiterate women at 57% as against males 43%. In Nigeria, girls and women comprises about 49.69% (SAPA 2008) of the total populations. Women are discriminated against access to education for social and economic reasons.

It is a matter of great concern that in spite of worldwide awareness and effort at gender equity participation in the STM education enterprise at the university level, female enrolment appear considerably very low when compared to the British, Usa, Canada and Australia (Maduabum 2018).Using available data collected over a period of ten(10) years (2013-2023) from the National University Commission (NUC), Nwosu-Izuwa (2023) found that there were still far fewer females than males in Nigerian Universities by academic year and sex, faculty and sex, an level of course and sex.

In a study on gender differences in educational participation and performance in science, technology and mathematics; Nigeria perspective (Maduabum 2018), it was established amongst other things that in all the six academic sessions (2017/2018 – 2022/2023) considered the ratio for males was higher compared to females in science an technology enrolments. More especially, it was 5:2 in each of the first three academic sessions (2011/2017-2017/2018), 3:1 in (2018/2019) session; 5:2 again in (2019/2020) session and 2:1 in 2020/2021

The Role of STME in Women Empowerment

Education is important for everyone, but it is especially significant for girls and women. This is true not only because education is an entry point to other opportunities, but also because the educational achievement of women can have ripple effects within the family and cross generations. Investing in girl's education is one of the most effective ways to reduce poverty. Investment in education for girls yields especially high dividends.

Reproductive Health: women are more vulnerable than man to reproductive health problems. STME education helps to educate women on reproductive health problems. Provisions of education services and conditions helps women protect their reproduction health.

Stewardship of Natural Resources: women in rural areas are usually in charge of natural resources such as water and firewood. STME helps them to mange these resources to make maximum use of these resources.

Economic Empowerment: STME provides woman the opportunities to be gainfully employed in fields as teaching nursing, medicine etc. which earn them salaries to contributing to the up keep of the family are discriminated against.

Technological Know-How: with STME women can contribute to technological development of the country. Whatever, they produce can earn them income and make the country technologically advanced.

Education Empowerment: women are being discriminated against because of their illiteracy or low level of education attainment. Human with STM education will be recognized in the society and be given the opportunity to make the meaningful contributions.

Speaking on national development, Abbe and Momodu (2016), development means "bringing a nation to an advanced or highly organized stat that is utilizing all human

and material potentials of a nation to the ability about growth and advancement". National development therefore refers to the ability out potentials of a nation. It may also simply be the ability to flow among with others in terms of effective management and utilization of current development in science and technology (Aguele & Agwagah, 2022)

Women now constitute about one third of all industrial sector of the labour force in export processing activities and services sector such as tourism and banking (common wealth, 2016) hence, we cannot continue to undermine their total and complete involvement in issues of Nation Development in Nigeria.

The common wealth works towards a world in which women and men has equal rights and opportunities to all stages of their lives to express their creativity in all fields of human endeavour and in which women are expected and valued as equal and able partners in establishing values of social justice. Within such a frame work or values, women and men will work in collaboration and partnership to ensure people oriented development for all nations (Commonwealth 2016:10). Such a plan recognizes the fact that woman are very vital and indispensable in national development and we can therefore, not continued to undermine them.

Strategy for Women Empowerment

The effective strategy for empowerment is education. Majasan (2014) asserted that development in any society is anchored primarily on Education progress. Education is the cornerstone of economic and social development. The future of any nation hinges on the capacity of individuals to acquire, adapt and advance knowledge.

To make education more accessible to women, informal education is created for women and those that cannot go to the formal education. Open and distance learning is a scheme that affords a nation the opportunity to effectively Train her citizens, especially those denied access for one reason or the other. Nigeria women undoubtedly fall within this category and it affords them the opportunity to pursue the gift of knowledge without contradicting any societal dictates. Informal education is good for the following group of women. Those who have never had access to formal education or had to give up at early stages of their lives and nomadic women who are always on the move with their families.

Empowerment Through Credit Programmes

Micro-credit programmes, many targeting and empower women have become extremely popular among donors and NGOs in recent years. Credit schemes are seen to having the potential to link women with women with the formal banking sector and thereby integrating women in mainstream development (Bulo, Damball ster & mavon 2016). Aimed at woman empowerment attempt to follow the model of well-known micro-credit providers such as Fadama lll The problem of high administration cost and lack of collateral of small-scale women borrowers are overcome by establishing borrow solidarity groups based on joint liability.

Empowerment through Political Participation

One important approach to supporting women's empowerment is the promotion of the participation of women in formal politics, alongside support of broad programmes of democratization and good governance with a strong focus on developing civil society. This includes promoting women's involvement in NGOs and woman's movement (Oxalal & Baden, 2016) in 2004, only 5.7% of the world's cabinet ministers were women (UN.2015.) there is a range of possible mechanisms to increase women's participation in political life which have had varying degrees of success including:

- ❖ Training to develop women's skills and gender sensitivity
- ❖ Work with women's sections of political parties,
- ❖ And the development of women's political organization.

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Empowerment, Sexual and Reproductive Rights and Health

Links between empowerment and health in general and specifically for women are receiving growing recognition. These links are also gaining recognition in international development agencies. A WHO position paper on health education links community participation to empowerment as a means promoting healthier individual and environment (WHO, 2014). The WHO position paper on women health produced for the fourth world conference on women, Beijing state.

The empowerment of women is a fundamental prerequisite for the health. This means promoting increased access for women to resource, education and employment and the protection and promotion of the human right and fundamental freedom so that they are enabled to make choices free from coercion or discrimination (WHO 2014:8).

The international women's health movement stresses women's health and empowerment as goals in their own right and not as a means to reduce fertility. For example, the women declaration and population policies and reproductive right project, emphasize the empowerment of women, as well as gender equality, including men's responsibility for their own sexual behavior.

Problems of Women Empowerment in Nigeria

The major problems of women empowerment in Nigeria is that women are discriminated against in access to education for social and economic reason. For instance, the Islamic practice of purdah precludes many women from benefiting from school instructions and/or participating in economic activities, which are likely to elevate their positions. The large part of the empowerment process is associated with education of the women themselves.

The root of the problem is the degree of importance women themselves have attached to education. Many of them believe that the life of a successful woman resolves around

her children, her husband and domestic chores. This lack of personal ambition prevents her from thinking about pursuing other educational grabs, which may have greater influences on her life. In the case of working women in the cities, there had been gradual predications to abandon further studies because of the demands work and family as well as the huge costs associated with pursuing higher studies in conventional school system or universities.

Improving women's access to credit is a positive step, but is by no means enough to secure their economic empowerment. Research showed that a significant proportion of women's loans were controlled by male's relatives (Goetz & Gupta, 2017). High repayment rate of loans by woman cannot be taken as clear evidence that woman have made effective loan investments, that they have been empowered through the loan. Where men take control of loans and invest them badly, women's position may even be worsened, as women may be forced to mobilize repayment funs from resources which could otherwise be used for consumption or saving.

Conclusion

Women constitute about half of Nigeria population. By the March 2006, census of 140million, of 71,709,000 males and 68,293, 683 females (Adediran, 2014) Nigeria as a developing nation needs more scientists, engineers and mathematicians to help her develop her own technologies and to get along with develop nations. Women must be fully involved and can never be ignored in any meaningful development. They have a distinct way of seeing and interpreting the world. Their impact through STME should therefore be encouraged.

Suggestions

In order to improve upon the participation of woman in STME and to empower them economically and integrate them into the mainstream of national development:

1. Programmes that provide student an opportunity to engage in hand-on real life project would be successful in increasing female enrolment and retention. Some of these programmes include soap, pomade making and dying of clothes.
2. Mentoring programmes that help socialize student in STME fields, which are other support for women, should be established. The presence and guidance of faculty mentor have been shown to positively affect retention in school. For women in the science, mentor can help to provide a support network that would increase student's self confidence and feeling of worth in the field.
3. Females studying STME course should be awarded scholarship to encourage and to serve as motivation to them. This would attract others to enroll. Females graduate in STME course should be provide automatic employment opportunities. This would serve as creating more opportunities for them to contribute to national development
4. Workshops, seminars and conference show casing women and young girls. Government should be ready to invest heavily in STME education. Good salaries and allowance should be paid to STME teachers. The necessary materials and equipment and infrastructure needed should be made available. Conducive

atmosphere for teaching and learning should be provided. Distance learning should be organized in strategic location to encourage women enroll in.

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