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Engaging Government In ICT Policy Formulation for Girl-Child Participation in Science, Technology, Engineering, Art and Mathematics Education in Nigeria

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Abstract
Globally, since 2000, study after study has made it clear that there is an alarming crisis in relation to students' interest in STEAM education particularly biology. This paper examines the influence of government policy engagement in Information Communication Technology of the girl-child in Science, technology, engineering, art and mathematics (STEAM) in Nigeria.It viewed ICT simply as communication gadgets or equipment that have modernized, improved and eased exchange of ideas and information of various kinds between and among people within or across distant boundaries/frontiers. A gender-responsive ICT policy is one that equally considers and addresses the connectivity challenges and needs for all groups in society, and takes into particular consideration the unique challenges faced by women and girls.
The paper outlined following as strategies that should be employed to ensure the girl child have access and engagement with ICT facilities for STEAM learning: Development of ICT infrastructure; Enabling environment; Government Engagement of Stakeholders; Legal, institutional and regulatory framework; Exploring partnerships; How ICT will facilitate growth and the achievement of development objectives; and using a multi-stakeholder approach is required for the development of ICT policies and strategies. It identified some Factors That Restrict Women's Equal Participation in ICT and STEAM to include among others: Lack of government leadership and direction; Ignorance; Gender issues;Globalization and Technological Changesin addition to cultural, social and religious undertones. It concluded that ICT provides every opportunity to improve the challenges facing the women and girl child education in STEM education, Technology, Engineering, Arts and Mathematics in Adamawa State. Therefore, policy reform is required in bridging the gap in the accessibility, participation and engagement of girls and women in STEAM using ICT educational resources.

Keywords: Government Policy Engagement, Information Communication Technology, Girl-Child, STEAM education, Technology, Engineering, Art and Mathematics

Epigraph

"On a worldwide scale, STEM education... is still a man's business. This situation is no longer acceptable. It is economically unacceptable because of the waste of human resources that it entails; it is humanly unacceptable since it prevents half the population from taking part in building the world; it is intellectually unacceptable as it deprives scientific and technological research of ideas and methods, in a world, of creativity……."
(—Federico Mayor (1999), the Director General of UNESCO2019).

1 Introduction

Globally, since 2000, study after study has made it clear that there is an alarming crisis in relation to female students' interest in STEM educationand technology particularly biology, either as a possible future career, or as an intrinsic interest that will continue after school (Fensham, 2008). Girl-child education is the process through which the girl child is made functional members of her society. It is a process through which the girl-child acquires knowledge and realizes her potentialities and uses them for self-actualization, to be useful to her and others (Olaniyi, 2021).
UNICEF report in Olaniyi (2021) indicates that some 121 million children are out of school for various reasons and 65 million of them are girls. With the educational rights of 65 million girls unmet, something should be done to ensure that they complete their education. The same report indicates that Nigeria is one of the 25 developing countries of the world with low enrolment rates for girls, gender gap of more than 10% in primary education and with more than 1 million girls out of school (Olaniyi, 2021).
According to the UNESCO (2020) groundbreaking report on cracking the code: girls' and women's education in STEM reveals that only 35% of STEM students in higher education globally are women and differences are observed within STEM disciplines. For example, only 3% of female students in higher education choose information and communication technologies (ICT) studies. This gender disparity is alarming, especially as STEM careers are often referred to as the jobs of the future, driving innovation, social wellbeing, inclusive growth and sustainable development (UNESCO, 2020).

In Nigeria, an average girl-child faces significant obstacles in accessing proper education because of many circumstances, including socio-cultural norms and economic barriers and practices that inhibit formal education, especially for girls (Olaniyi, 2021). According to the Nigeria National Bureau of Statistics (2020) report, the percentage of males and females in the total population is approximately equivalent: 49.2% and 50.8%, respectively. This model is comparable across rural-urban areas and the states. However, more male children are in school than female children in Nigeria. According to a UNICEF (2015) report, the female adult literacy rate (ages 15 and 9 above) in Nigeria was 49.7% compared to that of males, 69.2%, with a gender difference of 19.5%. In the northeast part of Nigeria, the picture is even bleaker (Olaniyi, 2021).

According to U.S. Bureau of Labor Statistics (2020) globally, women make up only 28% of the workforce in science, technology, engineering and math (STEM), and men vastly outnumber women majoring in most STEM fields in college. The gender gaps are particularly high in some of the fastest-growing and highest-paid jobs of the future, like computer science and engineering. Women in STEM Occupations: Biological Scientists 46% Chemists & Materials Scientists 40.4% Computer & Mathematical Occupations 25.2% Engineers & Architects 16.5% (U.S. Bureau of Labor Statistics, Table 11, 2020).

Therefore, empowering girls and women to enter STEM fields of study and careers, and stay the course, is an imperative (UNESCO, 2020). As Ministers of Education and other stakeholders pointed out during the UNESCO International Symposium and Policy Forum on this topic (Bangkok, 2017), this requires holistic and integrated responses that each across sectors and engage girls and women in identifying solutions to persistent challenges. Therefore, UNESCO's work in this area aims to:

i. Improve the participation, achievement and continuation of girls and women in STEM education and careers to reduce the gender gap in STEM professions
ii. Strengthen the capacity of countries to deliver gender-responsive STEM education, including through teacher training, educational contents and pedagogy
iii. Enhance awareness of the importance of STEM education for girls and women.

The list of countries experiencing declining interest of students in STEM education is on the increase in both developed and developing countries of Africa (Fensham, 2008). One factor which has contributed to low interest in biology by students is the method adopted for teaching and learning STEM education. Fensham (2008) listed four views of students which contribute directly to low interest in STEM education:

(i) STEM education teaching is predominantly transmissive, (ii) The content of STEM subjects has an abstractness that makes it irrelevant, (iii) Learning STEM is relatively difficult, for both successful and unsuccessful students particularly girls, and (iv) Hence, it is not surprising that many students in considering the senior secondary years as waste: Why should I continue studying STEM education subjects when there are more interactive, interesting and less difficult ones to study? Fensham asked (Fensham, 2008 p. 20-21).

This unhealthy development in the disposition of students towards STEM subjects has sparked the search for and development of alternative methods of STEM teaching and learning which can stimulate students' interest and guarantee an educational system that offers equal opportunities for all sexes (Ekine, 2013). STEM education as a field of study is therefore in dire need of methods with qualities such as lesson clarity, promotion of self-activity, promotion of self-development, stimulation of interest and curiosity and relying on the psychological process of teaching and learning to recommend to biology teachers (Ajaja, 2013). The methods should encourage biology teaching and learning that is better than it is now. Many students today are learning biology in a passive way in classrooms where information is organized and presented to them by their teacher (Moyer, Hackett & Everett, 2007). They noted that "often, the teacher pays little attention to what students already know about STEM education. In this learning model, the information transmitted by the teacher and curriculum materials is assumed to make sense and seem reasonable to the students" (Moyer, et al., 2007 p.4).

Like other countries in the Global South, Nigeria has in recent years sought to ensure equitable access to education for all. In this context, girls' access to education has received attention at the policy level, and progress has been made toward gender parity in enrollments in some regions of the country. However, far less attention has been paid in Nigeria to the quality of children's learning and to girls' participation in different areas of learning, including STEM education and technology

The major dilemma that Nigerian youths particularly the girl-child are faced with is the inability to create jobs and businesses which will enable them not only become self-employed but also become self-reliant capable of creating jobs attributed to low level of STEM education particularly among girl-child (Igwebuike., & Ikponmwosa, 2013). To confirm this, the UNESCO Global Education forAll (EFA) Monitoring Report 2015, indicted that Nigeria has 10.5 million out-of-school children - the highest number in the world. 60 per cent, of them live in the northern part of the country and of this figure over 71 per cent are girls and women as reported by Reed (2019) reporting for UNESCO. Graduates in skill oriented field of study like STEM education, Technology, Engineering, Arts and Mathematics (STEAM) subjects known for their capability of equipping learners with life skills that enhance self-reliance, independence, empowerment and self-employment continue to search for paid employment instead of being job creators (Igwebuike., &Ikponwwosa, 2013). This situation is further compounded by women and girls lack of access to, skills and engagement in ICT and STEAM related fields.

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The reality of ICT convergence has not yet been reflected in Nigeria where the institutions that regulate and/or develop the ICT sector still function as distinct actors in the industry, without much coordination (FGN, 2012). Though there have been significant gains over the last decade, especially with regard to mobile telephony, the lack of industry convergence in the Nigerian ICT sector has resulted in fragmentation and inefficient management of resources.

The goal of this National ICT Policy therefore is to provide a framework for streamlining the ICT sector, and enhancing its ability to catalyze and sustain socioeconomic development critical to Nigeria's vision of becoming a top 20 economy by the year 2020. Concurrently, the policy thrusts will facilitate the transformation of Nigeria into a knowledge-based economy and will be used to develop action plans, sub-sectorial policies and specific implementation guidelines as appropriate.

On October 17 2017, the World Wide Web Foundation and Paradigm Initiative hosted a Workshop on Closing the Digital Gender Gap (CDGG) and Mainstreaming ICTs into Women's Rights Policy and Program Frameworks (WRPPF) in Nigeria. The Workshop, suggested for exploring the existing government digital literacy initiatives able to reach rural/urban poor populations: e.g. The Office on SDGs working on initiatives to connect people in remote areas through various programs in its state offices nationwide (Paradigm, 2017).There should be an effort to map and coordinate existing government and cooperate initiatives around bridging the digital divide in the use of ICT in STEAM in schools, (such as initiatives from NITDA, TETFUND, MTN, e.t.c) with the aim to avoid waste, redundancy and duplication of efforts, and to promote programme effectiveness.

The CDGG Workshop, also touched on the role of government stakeholders in working together to ensure the right mix of regulatory initiatives and intervention not only needed to encourage greater competition among market players but also to encourage deeper penetration and use of ICT services. In this respect, it will be tempting to ask:

1. To what extent has the government implemented concrete policy goals for gender equity in internet access and use?
2. To what extent has the ICT policy supported girls' participation in STEAM?
3. To what extent has ICT increased access to information for the girl child in improving STEAMlearning?
4. How can government policy engagement in ICT of the girl-child in STEAM in Nigeria?

The paper will attempt to answer these questions through secondary review of relevant and current literatures.

2 Information Communication Technologies (ICTs)

Information and communication technologies are often synonymously used with New Media or New Communication Technologies. They are simply communication gadgets or equipment that have modernized, improved and eased exchange of ideas and information of various kinds between and among people within or across distant boundaries/frontiers. ICTs extend and change the entire spectrum of technological possibilities for public communication. Tiamiyu (2003) describes ICTs as a generic name used to refer to a number of communication hardware adopted in ensuring instantaneous dissemination of information and social values across the globe. It is also a disparate set of communication technology that shares that digitization made possible and is widely being made available for personal use as communication device. The essential features of the ICTs lie in their interconnectedness, their accessibility to individual users as senders and/or receivers, their interactivity, their multiplicity of use and open ended character and their ubiquity. These features essentially describe a computer-mediated medium, the internet.

Women's marginalization from ICT stems fromthe assumption that women benefit less from neweducational and employment opportunities. Genderdifferences also exist with regard to access toinformation, access to ICTs, developing skills to searchfor information, and the very use of these technologies in STEAM.

In an entrenched patriarchal society like Nigeria, women and girls were much less likely to use media especially computer based media. This is partly because women lack thenecessary skills to make use of the ICTs and had manynegative attitudes about these media. Notwithstanding,in recent years there are some changes in women's useof the ICTs whereby they are now developing skillsneeded to operate this new technology effectively. Thepotential of the ICTs for the advancement of women isconsiderable. Networking, research, training, sharing ofideas and information– all these could be infinitely easierthrough relatively affordable computer-mediatedcommunications such as E-mail, Internet hypertext andhypermedia (Steffen, 1995).

3 What is a gender-responsive policy?

Rufai (2004) stated that for any country to succeed and develop economically and technologiclly, girl child education should be a focus for policy formulation and implementation as far as democracy in concerned.A gender-responsive ICT policy Rufai argued is one that equally considers and addresses the connectivity challenges and needs for all groups in

society, and takes into particular consideration the unique challenges faced by women and girls when it comes to accessing and using the internet. In so doing, it helps to ensure equal outcomes for women and men.

Developing a truly gender-responsive ICT policy starts with the recognition that technology development and use are both subject to existing socio-economic biases and institutional discrimination.From this base, policymakers can begin to identify the specific challenges and barriers that women and girls face in accessing and using broadband, and can develop the appropriate policy responses to reduce the gap.

The right policy environment is critical to the success of internet access and use, and, ultimately, to achieving universal, ICT or broadband policy that clearly outlines targets and strategies for increasing internet penetration tend to have higher rates of broadband adoption (anyPolicy to Empower Women ICTshould be affordable and efforts should be made to increasetheir access to internet.

These policiesidentify investment mechanisms to achieve policy goals,are updated regularly to reflect the evolving policy needsof new technologies, and include measurable, time bound targets for improving access and reducing prices.

Closing the digital divide means closingthe gender digital divide — a feat thatwill require policies that include all of theaforementioned characteristics, as wellas a gender-responsive approach to thedevelopment and implementation of thepolicy.

Gender-responsive broadband planning isnot just about making policy for women; rather, it is policy that ensures that all groups have equalopportunities to access and make use of broadbandservices. The more people that come online, themore a person is able to connect with friends andfamily, increase business opportunities, organise, andshare knowledge and ideas. Thus, gender-responsivebroadband policies will also be successful broadbandpolicies

4 Factors That Restrict Girl-Childs Equal Participation in ICT and STEAM

The problems militating against the girl child education in Nigeria is an age long factor that hinges on cultural, social and religious undertones where the girl-child is perceived as inferior to the male and hence denied access to education and her roles relegated to that of a home maker, child rearing and house keeper. Others gender issues that hamper the larger participation of girls and women in education in general and ICT training in STEM education in particular include:

a. **Lack of government leadership and direction**: E-governance is for transparency in government operations, improving the quality of government's service delivery, improving efficiency, accountability, financial management, information management, reducing bureaucracy, and delivery of public policy in STEAM. It also affects the enhancement of government ICT infrastructure, supporting an enabling environment as mentioned earlier and providing leadership by making ICT a national priority. Often leadership can make the difference between failure and success. A government that does not appreciate the strategic opportunity provided by ICT cannot provide the required leadership.
b. **Ignorance** is a monster retarding the growth and use of ICT. Policies will deal with ICT diffusion, and ICT literacy, and awareness of the benefits of ICT, the creation of new economic and social opportunities for poverty eradication, job creation and empowerment.
c. **Gender issues:** There is a need for policies to address the issue of equal access of women to ICT. How can the specific developmental needs of women be met? How gender sensitive are the policies?
d. **Globalization and Technological Changes:**Our education system is being challenged in its ability to remain relevant to the needs of students, society and the economy; and in its role to provide the research innovation and creativity that will support the grand challenges facing society that will take us into the 21st Century and beyond.

5 Strategies for enhancing Government ICT policy engagement for Training girls in ICT Skills in STEAM Education

The following are strategies that should be employed to ensure the girl child have access and engagement with ICT facilities for STEAM learning:

1. **Development of ICT infrastructure**: It's not just about provision of infrastructure but also quality, quantity and access issues. Access to infrastructure should lead to access to relevant content and services. Availability and reliability are important, but price is often the most critical factor that affects access.
2. **Enabling environment**: An enabling environment is critical for girls' effective participation in STEAM in the Information Society. Such an environment is supportive and provides support for ICT empowerment while eliminating constraints.
3. **Government Engagement of Stakeholders:**The government should engage stakeholders in ICT and STEAM in working together to ensure the right mix of regulatory initiatives and intervention, resources and facilities needed are provided and made available for use by girls to encourage deeper penetration and use of ICT services teaching and learning of STEAM subjects.

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4. **Legal, institutional and regulatory framework**: Legal, institutional and regulatory framework is required to ensure fair competition; to attract investment; to develop ICT infrastructure, solutions and applications; to provide tax and other incentives for ICT industry and investors; to support transfer of technology; to meet the needs, priorities, aspirations of various stakeholders especially for the girl child effective participation in STEM.
5. **Partnerships:** Exploring partnerships around existing government digital literacy policies and initiatives able to reach rural/urban poor populations: e.g. connecting with the Office on SDGs working on initiatives to connect girls in remote areas schools through various programs in its state offices nationwide.
6. Creating a good rapport with the girl-child - having a regular talk show with girl-child in the school concerning their academics, career in STEAM and personal problems will create room for the girl-child to express her problems.
7. **Girl-Child Motivation:** Providing incentives for the girl-child such as food, transportation and school fees- The schools visited in this research recognized incentives as a motivator for the girl-child participation in STEAM
8. **Teachers Incentives**: The need for teachers' welfare cannot be overemphasized as the wellbeing of the teacher determines the performances of the teachers and students. STEAM Teachers' salaries should be increased and incentives should be given to them to encourage good output in their career and support for the girl-child..
9. **Parental Involvement:** Educating the parents through PTA meetings – through PTA meetings, the girl-child education can be introduced to parents. The need for girls to acquire functional education, necessary for engendering economic, political and social emancipation should be stressed to the parents.
10. **Availability of the counseling unit to all schools:** Counselors should make guidance services, such as group and individual counseling and information services, available to all in their community. These services will focus on the benefits that are imbedded in the provision of equal rights and opportunities to all irrespective of sex, religion, age and other differences.
11. **Stakeholders Sensitization:** Seminars, symposia, career talks, advertisement through media and pamphlets, skills development programmes and workshop could also be organized to sensitize community members and motivate governmental and non-governmental organizations to provide the necessary assistance to help in promoting girl child education in STEAM.

It is already widely accepted that Information and Communications Technologies (ICTs) are an important enabler of growth through the wealth creation, increased productivity and the creation of opportunities. This is particularly important when used in STEAM subjects with the girl child. Therefore, the adaption of the five strategies above will go a long wy to ensuring effective participation and engagement of girls in STEAM.

6 Conclusion

In view of the above, it is evident that ICT provides every opportunity to improve the challenges facing the women and girl child education in STEM education, Technology, Engineering, Arts and Mathematicsin Adamawa State.Therefore, policy reform is required in bridging the gap in the accessibility, participation and engagement in STEAM using ICTeducational resources.It is therefore worthy of note that encouraging women and girls to ICT in STEAM in terms of provision and adaptation in our institutions of learning will go a long way in helping the girl child phase out the challenges that will impede her educational achievement. ICT therefore is a vehicle that can change the STEM education barriersthat are pulling the girl child. back.

Recommendations

From the above discussion, the following recommendations have been proffered;

1. ICT should be integrated into the STEAM curriculum mostly in terms of methodologies for instruction through a deliberate policy that will enforce compliance.
2. The provision of ICT facilities to girls at affordable prices in our schools to be supported by training in its use for STEAM learning.
3. The teachers should be made to develop supportive classroom environment that facilitates the adaption of ICT based learning in STEAM by girls to minimize boys/girls disparity in ICT compliance which has been a hindrance to the girl child interest, engagement and participation to ICT and its numerous benefits to learning.
4. More interventions should be encouraged mostly in the areas of private public partnership in the provision of ICT facilities useful in the learning of STEAM subjects by girls in our schools and the training of girls in the usage of ICT in form of seminars, workshops and formal trainings in a safe, secured and friendly environment should be encouraged.

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