



A WAY FORWARD IN ENHANCING THE PARTICIPATION OF THE GIRL-CHILD IN PHYSICS EDUCATION.

By

Theresa Ugonwa Okafor

Department of Science Education

Chukwuemeka Odumegwu Ojukwu University, Uli Campus, Anambra State, Nigeria.

teresakafor@gmail.com

Abstract - Physics has become the bedrock of many nations' socio-economic development for sustainability. The study was a descriptive survey research design to investigate a way forward to enhance girl-child participation in Physics Education. The study was carried out in the forty-two public secondary schools in Aguata Education Zone of Anambra State. The population consisted of 232 Physics teachers in the education zone. Simple random sampling techniques were used to select 120 female Physics teachers and 80 male Physics teachers for the study. Two research questions and one null hypothesis guided the study. Data was collected using a-26 item structural questionnaire developed by the researcher. The reliability of instrument was established using Cronbach Alpha giving a reliability index of 0.84. Mean and standard deviation were used to answer research questions while t-test was used to test the null hypothesis at $P < 0.05$ level of significance. The findings showed that early marriage, poverty, cultural/traditional belief, sex bias etc were obstacles to girl-child participation in Physics education. Some strategies to enhance girl-child active participation in Physics education such as modification of Physics teacher's behaviour, awareness of campaigning at the grass root and national levels to discourage parents from denying their girl-child access to proper education by subjecting them to early marriage, child labour etc were highlighted. Elimination of masculine images of textual materials which discriminate against girl-child was emphasized. Educational implications were discussed and recommendations were made.

Key words - Participation, girl-child, Physics education.

INTRODUCTION

The development of any nation requires that her citizens should be adequately empowered to be able to contribute their quota meaningfully and appropriately as responsible productive citizens. This empowerment is mostly achieved through creative and relevant science education especially physics education leading to critical thinking, problem solving and being ICT literate (Nwankwo and Okafor, 2015).

Physics, defined by Henry (2009) as in Nwankwo and Okafor, 2015 is the rational development of experiments, observations and theories to explain the fundamental structure of

all we perceive which is crucial for effective living in this jet age of science and technology.

Physics has become the bedrock of many nations socio-economic development for sustainability. According to Shehu, Yohanna and Ayodele (2017), physics as a branch of science is defined as the study of nature, properties of matter, energy and their interactions which answer questions about natural occurrence on earth and beyond. No nation will be economically buoyant if its citizens especially women lack the knowledge of physics. For example Shelm et al (2017) observed that a girl-child must have the knowledge of physics before she can make use of her electrical appliances.

The girl-child is a biological female offspring within the age of 0 to 18 years. The period according to Offordum (2010) in Okoye & Onwuachu (2013) covers the crèche, nursery, early childhood (0-5 years), primary (6-2 years) and secondary school (12-18 years). The United Nations convention on the right of the child stated that "a child is any person under the age of 18 years (Okoye and Onwachu 2013). Also Borisade (2010) in Okoye and Onwuachu (2013) defined the girl-child as a female between the ages of 0-16years who grows up to be the mother of a nation. During this period, the young child is totally under the care of the adult who may be her parents or guardian or older siblings. At this period she is very dependent on whom she models her behaviour, through observation, repletion and imitation. Her physical, mental, social, spiritual and emotional development starts and advances to a young adult state (Offordum, 2010).

The importance of Physics education is the right of every girl-child everywhere and also the key to transforming her life and the life of her community. Without Physics education girls are denied the opportunity to develop their full potentials and to play a productive and equal role in their families, societies, countries and the world. The laws of thermodynamics are very significant to every girl-child in the society. This is because ordinary household utensils and appliances (peculiar to girl-child) are designed in whole or in part by using the laws of thermodynamics. For instance, the heating and air conditioning



systems, the refrigerator, the pressure cooker, the water heater and the pressing iron a girl uses at home, all have their bases from the thermodynamics aspect of physics. Furthermore the study of radioactivity in physics will be helpful to every girl-child towards the skill acquisition in the field of agriculture (Shehu et al, 2017). This is also to study the uptake of fertilizer or minerals in plants, production of fertilizer and in food preservation. Physics education therefore is the life wire of every girl-child in any society since its roles has permeated virtually all aspects of her existence on earth. This according to Offordum (2010) conforms to an adage that says, "Educate a man, you educate an individual, but educate a woman, you educate a nation".

The above summarizes the essence of physics education to the girl child. Physics education acts as a catalyst for all forms of development for which every girl-child must be affected (Eyetermitan, 2003). Similarly, research has shown that millions of girls do not have access to school despite the concerted effort to push the cause forward (Shelm et al, 2013). Okeke (2007) and other researchers identified many factors militating against girl-child education especially in physics education which includes: early marriage, poverty, socio-cultural belief, child labour, lack of sponsorship, quest for wealth, bereavement, waywardness etc. Also UNICEF (2007) reported that in sub-Saharan Africa, the number of girls out of school each year has risen from 20 million in 1990 to 24 million in 2002. Also, of the 25 selected countries studied, fifteen (15) were in Sub-Saharan Africa. The criteria studied were: low enrolment rates for girls; gender gaps of more than 10 percent in primary education; countries with more than one million girls out of school (Shelm, et al 2013). According to them, the fifteen countries included are; Chad, Nigeria, Sudan, Tanzania, Eritrea, Ethiopia, Sierra Leone, Burkina Faso, Ghana, Cameroon, Botswana, Gabon, Zimbabwe, Niger and the Democratic Republic of Congo. The girl-child in these countries appears to be the most vulnerable and most undervalued members of the world society hence is at the centre of the devastating situations, more also as it concerns science education especially physics. This therefore calls for a way forward in enhancing the participation of the girl-child in physics education.

It is true that many governments make provisions for science education (Physics) of their citizens, but the provisions most of the time do not take cognizance of the peculiarities of the girl-child or woman participation in physics education. For instance, Okebukola (2003) observed that about 50% of the population in Nigeria are woman and only 11% in science (physics), engineering and technological professions are women. The situation is not different from what exists in some other Africa countries as highlighted by Ibraheem (2000). If physics education especially is a vital tool to national development, then there is need for more women or girl-child to be involved in physics education. In other words, the involvement of more girls or women in physics education will greatly enhance girls to acquire physics skills for sustainability and hence for economic and national development. This therefore calls for a way forward

in enhancing the participation of the girl-child in physics education.

Okeke (2007) in Shelm et al (2013) suggested that increase in female participation in science education especially physics will involve a re-appraisal of science education experiences women are exposed to, and secondly the strategies that can change societal values and practices. Okeke (2007), further outlined the following strategies for increasing female participation in science education, physics in particular. These include: science teachers and administrators to be informed and trained in instructional strategies and behaviours that enhance female participation in science especially in physics. They must examine and restructure the attitude and practices that undermine the potentials of females in sciences in general and physics in particular. The first level will focus in exposing gender issues in physics education; conferences, seminars and workshops can be organized at the national and local levels in which physics teachers, administrators, guidance counsellors, policy makers and stakeholders can participate. Resource personnel may be drawn from experts within and outside the country to focus on gender stereotyping practices in physics education. Also problems and prospects of women in science especially women in physics and engineering careers, relevance of physics education curriculum and national development, influence of school and home on the cognitive and effective development for sustainability in physics may be examined.

- Furthermore, studies of physics curriculum materials in USA which are similar to those in African schools reveal some areas of modifications to make the physics curriculum gender fair. Examples of suggested modifications are: the incorporation of social aspects of science especially physics which have special appeal for girl-child or women, such as industry, health-hazard, food distribution, agriculture etc. The inclusion of female experiences, interests and aspirations as legitimate and important physics activities e.g health care.
- Providing for the use of various learning styles and models such as co-operative learning.
- Relating physics concepts to applications of job and careers.
- Removing the masculine image of physics science text and other physics curricular with respect to changing societal attitudes and values, public enlightenment programmes have to be organized. Printed materials, radios and television can be used to reach a wider population. The target group will be market women associations, church groups, parent-teachers associations, co-operative unions, and cultural groups. These strategies may be successful in girl-child or women in participating actively in physics education to achieve meaningful development of the nation. (Shehu et al, 2013).



Nonetheless, Illiya (1998) as in Okoye & Onwuachu (2013) mentioned some successful African women that emerged as great women scientists which include; Grace Alele- Williams, Professor of Mathematics and University vice chancellor, Dorathy Akunyili, Professor of Pharmacy and director of Drugs and Food Agencies in Nigeria, Lydia Makhube in Swaziland, professor of chemistry. Also other women scientists mentioned by the researcher include; Eunice Okeke, professor of Science Education; Uche Nzewi, professor of Science Education, Rev. Sr. Benerdeth Ezeliora, professor of Science Education, Francisca Nneka Okeke, professor of physics, Nnenna Nnannaya Oti, professor of Soil Science & Environment etc.

Finally Offordum (2010) mentioned the values of educating the girl-child in Physics and Technonology Education which includes; transformation of socio-cultural values, that is, the tendency of acquiring multiple socio-cultural adjustment patterns; modern change, that is from primitive and crude way of life to a modern scientific and technological stage. It gives a girl-child opportunity of learning modern skills and using scientific technological gadgets with ease. Good health care that is giving the girl-child opportunity to live in a healthy condition and, has the advantage of being a reliable and successful mother. Such girl-child no doubt sustains meaningful living, contributes socially, economically, politically, morally and otherwise to the national and international development of her nation. It is against this background that a way forward enhancing the participation of the girl-child in physics education is being investigated.

Research Questions:

The following research questions guided the study.

1. What are the obstacles to girl-child participation in Physics education?
2. What strategies can be used to enhance girl-child participation in Physics education?

Hypothesis:

One null hypothesis was formulated and tested at 0.05 level of significance.

Ho: There is no significant difference between the mean responses of male and female Physics teachers on the strategies that enhance girl-child participation in Physics education.

Method:

The study was survey research design. The study was carried out in the forty-two (42) public secondary schools in Aguata Education Zone of Anambra State with a population of 230 Physics teachers in Aguata Education Zone. Simple random sampling technique was used to select 120 female Physics teachers and 80 male physics teachers for the study. Instrument for data collection was a structured questionnaire developed by the researcher. The questionnaire was designed using four point rating scale of strongly Agree, Agree, strongly Disagree and Disagree. The instrument was face validated by three lectures, one by physics education expert another by measurement and evaluation expert and the other lecturer by expert in psychology department, all in Chukwuemeka Odumegwu Ojukwu University, Anambra State. The instrument was modified using their suggestions to ensure both face and content validity. The reliability of the instrument was established using Cronbach Alpha which gave a reliability index of 0.84. The method of administration of the instrument was on the spot administration with the help of two research assistants to ensure a 100% return. The research questions were answered using mean and standard deviation. A mean of 2.50 and above indicated ‘accepted’ while below 2.50 indicated ‘not accepted’. The null hypothesis was tested at 0.05 level of significance using t-test statistics.

Results:

The results were presented sequentially according to the research questions and hypothesis.

Research questions one:

What are the obstacles to girl-child participation in Physics education?

Table 1: Mean Responses of the Physics Teachers’ on the obstacles of Girl-Child participated in Physics education:

Table 1: Mean responses of the physics teachers’ on the obstacles of to girl-child participation in physics education.

S/N	OBSTACLES	FEMALE		MALE		DECISION
		X	SD	X	SD	
1.	Sex bias of the teachers	3.20	1.72	3.00	1.42	Agreed
2.	Broken home	2.85	1.55	2.50	1.67	Agreed
3.	Truancy	2.50	1.54	2.55	1.55	Agreed
4.	Bereavement	3.20	1.72	3.20	1.42	Agreed
5.	Quest for wealth	2.80	1.65	2.80	1.65	Agreed
6.	Lack of sponsorship	2.85	1.66	2.85	1.66	Agreed
7.	Literacy	3.00	1.92	3.00	1.42	Agreed
8.	Lack of interest	2.50	1.64	2.58	1.68	Agreed
9.	Early marriage	3.06	1.00	3.00	1.42	Agreed
10.	Child labour	3.00	1.69	3.50	1.68	Agreed
11.	Stereotyped gender roles	3.60	1.69	3.50	1.68	Agreed



12.	Ignorance	3.00	1.42	3.20	1.42	Agreed
13.	Poverty	3.00	1.42	3.00	1.42	Agreed
14.	Religious belief	2.85	1.66	2.85	1.66	Agreed
15.	Cultural/traditional belief	3.80	1.69	3.20	1.71	Agreed

Table 1 indicated that items 1 to 15 had their scores 2.50 and above which is the cut off mean. This therefore showed that the respondents agree with all the enlisted obstacles to girl-child participation in physics education.

Research Question two

What strategies can be used to enhance girl-child participated in Physics education

Table 2: Mean Responses Of The Physics Teachers’ On The Obstacles Of Girl-Child Participated In Physics Education:

S/ N	OBSTACLES	FEMALE		MALE		DECISION
		\bar{X}	SD	\bar{X}	SD	
16	Modification of physics teachers’ behavior in the class	2.94	0.84	2.75	0.88	Agreed
17	Elimination of sex bias in physics teacher student classroom interaction	2.85	0.88	2.78	0.79	Agreed
18	Adequate provision of physics facilities for hands-mind-on activities	3.00	0.65	3.10	0.74	Agreed
19	Awareness campaign should be organized at grass root and national level	2.94	0.84	3.10	0.74	Agreed
20	Elimination of masculine images of textual materials	3.00	0.65	3.10	0.74	Agreed
21	Government to make law against child labour	3.00	0.65	3.00	0.65	Agreed
22	Elimination of cultural/traditional belief against girl-child education	2.85	0.88	2.78	0.79	Agreed
23	Government should make a law against early marriage	2.94	0.84	3.52	0.68	Agreed
24	Discrimination against women physicist/scientists and engineers to be discouraged	3.20	0.65	3.00	0.65	Agreed
25	Free adult scientific literacy programmes	3.00	0.65	3.70	0.65	Agreed

for women	5	2	2	ed	
26. Government should make education free and compulsory for all girl child	2.94	0.84	3.52	0.68	Agreed

The result from table 2 showed that items of 16-26 have their mean scores to be 2.50 and above which was the cut-off mean. This revealed that the respondents agreed that all the items listed would enhance girl-child participation in physics education.

Hypothesis

There is no significant difference between the mean responses of male and female Physics teachers on the strategies that enhance girl-child participation in physics education.

Table 3: T-Test Analysis of the Male and Female Physics Teachers’ Responses on the Strategies to Enhancing Girl-Child Participation in Physics Education

Sources of variation	N	X	SD	Df	t-cal	t-crit	Decision
Female respondents	120	3.70	0.88	447	0.422	1.98	Rejected
Male respondents	805	3.35	0.88				
Total	200						

In table 3, t-calculated (0.442) is less than t-critical (1.98) at 0.05 level of significance. That is $t(cal) < t(crit)$ at 95% confidence level. The difference is statistically not significant; hence the null hypothesis is accepted. This implies that there is no significant difference between the mean response of male and female physics teachers on that strategies that can enhance girl-child participation in physics education.

Discussion

From the result of the study it was discovered that some obstacle like poverty, early marriage, ignorance, lack of interest, lack of sponsorship, truancy, broken home, sex bias of the physics teachers among others are the obstacles against a girl-child participation in physics education. This finding is in consonance with findings of Okeke, Nzewi and Njoku (2008) that identified in their studies numerous hindrances to girl-child access to Science Education (physics) in Nigeria.



The study also, revealed most of the strategies like elimination of cultural traditional beliefs against girl-child physics education, adequate provision of physics/science facilities for hands-mind-on activities, elimination of masculine images of textual materials, modification of Physics teachers' behaviours in the class, awareness campaigns at grassroots and national levels among others as strategies to enhance girl-child's participation in physics education. This finding is also in line with Okeke (2007) who observed that removal of masculine images of the physics textual materials, public enlightenment programmes will promote girl active participation in physics education.

Therefore, since physics education is the key to national development, girl-child or females that constitute 50% or more of our population cannot be left behind in the pursuit for socio-economic sustainability, and technological advancement of the nation.

Recommendations

Based on the result of the findings of the study, the following recommendations were made:

- Government should promulgate laws prohibiting early marriage, child labour, hawking and other forms of child abuse especially of the girl-child during school hours.
- Government should enforce a policy on free and compulsory education for all female children of school age.
- Practicing physics teachers should undergo in-service training and workshops on the best approaches and methods to physics instruction that may appeal to girls' interest.
- Individuals and organization should help to provide physics laboratory, equipment and materials for effective Physics teaching.
- Parents that keep their female children of school age at home to do domestic work or give them out as house helps should be arrested and prosecuted.
- Governments should intensify free adult scientific literacy programmes to reach illiterate women e.g market women, nomadic women and women in purdan to increase their literacy level.
- All physics textual materials should be made gender free.

Conclusion

Since physics education is the life wire of any nation, it should be a top priority in the federal and state government budget. This will give the girl-child opportunity of learning modern physics skills and technological knowledge to transform the nation economically, socially and otherwise for sustainability of the girl-child.

References

Eyesterman, K.O. (2003). Women education and self reliance in Nigeria issues and options. *Journal of knowledge preview*. 7, (3), 50-54

Ibraheem, T.I. (2002). Wining more girls and women for science and technology. A challenge to women STM education. In Busari, O.O. (ed). *42nd Annual Conference Proceeding of Science Teachers Association of Nigeria (STAN)*. 385-388.

Nwankwo, M.C. & Okafor, T.U. (2015). Refocusing, Physics education for creativity: An imperative for sustainable development *56th Annual Conference Proceedings Science Teachers' Association (STAN)*, 284-290.

Offodum, I.S. (2010). The need for girl-child education: Counselling implication. *Journal of Educational Research Ebonyi State University 1*, 18-21.

Okebukola, P.A.O. (2003). "Structuring Primary Science Teacher Education to win more girls in Science and Technology". *An address presented at the inauguration of (IACDPED) chapter of STAN*.

Okeke, E.A.C. (2007). Making Science Education accessible to all 23rd Inaugural Lecture of the University of Nigeria, Nsukka. University Press Ltd.

Okeke, E.A.C.; Nzewi, U.M. & Njoku, Z.C. (2008). *Tracking school age children's education status in UNICEF A Failed states*. Enugu UNICEF.

Okoye, P.O. & Onwuachu, W.C. (2013). A way forward in enhancing the participation of girl-child in Science, Technology and Mathematics. *Forum for African women educationalists Nigeria (FAWEN) 3*, 98-106.

Shehu, U.I.; Yohana, L.M & Ayodele, G.F. (2017). The role of Physics in socio-economic empowerment of society: The Nigeria experience. *STAN 60th Anniversary Conference Proceedings*, 364-369

UNICEF/FME. (2007). *STAN-Situation assessment and analysis of Nigeria children and women development right (A UNICEF Study in Nigeria, E-2007)*.