An Assessment of the Role of Basic Science Education in Poverty Reduction in the Sub-Saharan Africa: Nigeria as a Case Study

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Abstract

Most countries in the Sub-Saharan Africa are either underdeveloped or developing. The signs on ground (e.g. in terms of economy, agriculture, health and education) show that majority of citizens in these countries are poor. This situation should not be left unattended to. Past studies have focused on the assessment of the role of general and universal education in poverty reduction. Not much empirical evidence on the role of science education in poverty reduction in Nigeria has been documented. It is on the basis of this, that in this study, the author examined how the curriculum of Junior School Basic Science has been structured and the extent to which it can help in poverty reduction in Nigeria and indeed in the Sub-Sahara Africa. Three hundred and seventy-one Basic Science Teachers randomly selected from 103 Junior Secondary Schools in Ibadan Metropolis, Oyo State, Nigeria participated in the study. A questionnaire titled "Basic Science Education and Poverty Reduction" was used. Items contained in the questionnaire sought responses from the teachers on the extent to which the curriculum of Basic Science emphasize the applications of basic science concepts to real life situations and poverty reduction. Majority of the teachers were of the opinion that the existing science curriculum was not structured towards inculcating skills, in junior school students, for poverty reduction and solving of real life problems. The teachers suggested that the Junior School Basic science curriculum should be restructured so that pupils can acquire skills that can make them self-reliant, and contribute to economic development of their society.

Keywords: Poverty reduction, Science education, Science curriculum, Sub-Saharan Africa, Junior Secondary Schools, Nigeria

Introduction

Nigeria is a developing country and the signs on ground show that the majority of the citizens are poor. According to 2014 World Bank Survey, Nigeria is ranked 3rd among world top five poorest countries with 61% of its citizens living below poverty rate of $1.25 per day and Nigeria alone constituted about 7% of world poorest. The level of poverty being witnessed in Nigeria is common to many African countries in the sub-Saharan Region. This situation should not be left unattended to. Although some actions have been taken in the past, not much has been achieved. For example, during the World Education Forum held in Dakar in April 2000, the international community underscored the need to eradicate extreme poverty and gave its collective commitment to work towards this aim through education. The issue of Poverty Eradication and Education was extensively discussed at a workshop held in Kampala, Uganda in 2001. The workshop was orgainsed by United Nations Educational Scientific and Cultural Organisation (UNESCO, 2001). At the workshop, Julius Nyerere said that "Education is not a way to escape poverty but a way to fight it". This underscores the role of education in poverty alleviation.

A commitment to poverty eradication was also one of the most important outcomes of the World Summit for Social Development held in Copenhagen in 1995, where abject poverty was considered a severe injustice and an abuse of human rights. Its action programme proposes to support livelihood systems and survival skills to help poor people to combat poverty. Subsequently, the United Nations General Assembly declared the period of 1997 to 2006 as the first United Nations Decade for the Eradication of Poverty. One of the sectors to be developed in order to help poor people combat poverty was education. The role of education in poverty eradication, in close cooperation, with other social sectors is crucial (Goldemberg, 1998; Omoniyi, 2013; Ozturk, 2011). According to Omoniyi (2013), education fosters self-understanding, improves quality of lives and raises people's productivity and creativity thus promoting entrepreneurship and technological advances.

In addition education plays very crucial roles in securing economic and social progress thus improving income distribution which may consequently salvage the people from poverty. No country has succeeded if it has not educated its people. Not only is education important in reducing poverty, it is also a key to wealth creation (Ozturk, 2011). Within this context, one of the pledges of the Dakar framework for Action - Education for All: Meeting our collective commitments – was to promote EFA policies. However, past efforts have concentrated on encouraging universal primary education and adult literacy. Although this has yielded some positive results the ultimate is yet to be achieved. The impact of universal primary education and adult literacy on poverty reduction has not been actually felt in most countries in Sub-Sahara Africa, (at least in Nigeria). No doubt, universal and general education has a crucial role to play in the developments of nations; however, such education must have a focus. Perhaps in the effort at improving access to education, more emphasis should be placed on science education. Although there are science-based courses at the junior and senior secondary schools in most Sub-Saharan Africa, not much have been documented on the prospects of science-education in poverty reduction. More importantly, the extent to which the teaching and learning of sciences in junior secondary schools can help bring about reduction in the level of poverty of the students, their parents, member of their immediate environment and ultimately the society at large has not been fully studied. It is on the basis of this that research focuses on what promises teaching and learning activities in the science classroom at the junior school level can offer in the effort of reducing poverty in developing countries.

In Nigeria, at the junior school level (Age 10 to 14 years) Basic Science of one of the subjects that students must offer. There are three level of junior school level. These are Junior School 1, 2, and 3. At each of these levels, Basic Science is offered and students must take this subject and sit for it at the end of Junior School 3. By its contents Basic Science consists of subjects/topics from the core sciences such as Physics, Chemistry, Biology, and Agricultural Science. It used to be named Integrated Science. Whatever name it is called it is an attempt at introducing young ones to some form of formalized science. Science is the study of nature. It involves the understanding of natural phenomenon and it is a major source of discovery and economic development. According to Goldemberg (1998), the United States of America, countries in the Western Europe, Japan and China and other Developed Nations have achieved their feat because they have developed their science and technology education and moreover, have utilised and are utilising the products of well-developed science education programmes. For developing countries to reduce poverty and develop their economies, they must take the issues of science education more seriously. The lip service being paid to science education must stop.

Of course science teachers and students have important roles to play in this regard. The teaching and learning activities in the classroom must not focus only on academics only – that is teaching and learning-centred on acquiring chain of certificates, but rather geared towards using the acquired knowledge for creating wealth and reducing poverty. It is on the basis of this that this study examined the extent to which the curriculum of Basic Sciences at the Junior Secondary School level (JSS) focus on inculcating in the students such skills that can help them contribute to their personal development, development of their immediate society and more importantly reduce the level of poverty in their families and in their immediate society. Assessment such as this will show what are being done and also give suggestions on what can be done; all geared towards reducing poverty in Sub-Sahara Africa. In carrying out this study, the focus is on the definition of curriculum which emphasise not just the intentions (planned programme) but also the actuality of programme execution, reception and effects, both intended and unintended. Therefore, this study is anchored on the views of scholars such as White (1985) and Ihebuzor (1993) who viewed curriculum as total learning, planned and unplanned, overt or covert, explicit or implicit, intended or intended, that learners gained from exposure to instructions. To successfully examine the suitability of a given curriculum, Ihebuzor (1993) stressed that scholars in the field of curriculum studies should provide answers to issues such as:

a. What should be taught or studied?
b. Why should it be taught?
c. To whom should it be taught?
d. When should it be taught?
e. How should it be taught?
f. Where should it be taught?
g. How shall it be known to have been taught?

Indeed, according to Ihebuzor (1993), the central concern of any scholar in curriculum studies should be to provide answers to the what, why, to whom, by whom, how, when, and where of instructional programme. Issues such as these show that curriculum studies focus on unraveling the factors which influence the planning, design, delivery and implementation of programmes of instruction. In this study the focus was on subjecting the Basic Science curriculum to close scrutiny with a view to determining its societal relevance bearing in mind national goals, aspirations, objectives, and philosophy and more importantly, the millennium goals of using education to reduce poverty in sub-Saharan Africa. For the purpose of scrutiny, in this study, the opinions of Junior School Basic Science teachers were sought. The reason for this was that the teachers are the implementers of the curriculum and they are in the best position to give information on its contents and usefulness or otherwise.

Objectives of the Study

Specifically, the foci of this study included the following:

1. Assessments of the extent to which Junior School Basic Science curriculum encourage acquisition of skills, by the students, that can help reduce poverty.
2. Collate the opinion of teachers on how teaching and learning of topics in Basic Science, at JSS level, should be structured to help students develop skills to solve real life problems generate wealth?

Research Questions

The following research questions were answered.

1. To what extent does the Basic Science curriculum at the JSS level emphasise acquisition of skills, by the students, that can help reduce poverty in their immediate society?
2. How should teaching and learning of topics in Basic Science, at JSS level be structured to help students develop skills to solve real life problems and generate wealth?

Methodology

Participants

Three hundred and seventy-one Basic Science Teachers randomly selected from 113 Junior Secondary Schools in Ibadan Metropolis, Oyo State, Nigeria, participated in the study. The ages of the sampled Basic Science Teachers ranged between 25 and 56 years. Fifty-seven percent of them were women, while 43% were men. They have all taught Basic Science for at least seven years at the JSS level. They all possessed minimum qualification (National Certificate in Education) for teaching at the JSS level. Ibadan metropolis has five Local Government Areas. All public JSS schools and the Basic Science Teachers in all the schools in the five local Government Areas were the target population. However by using simple random technique, 113 JSS Schools were sampled and all the Basic Science Teachers in each sampled school were surveyed.

Materials

A questionnaire titled "Basic Science Education and Poverty Reduction" (BSEPR) was used. It was administered to the sampled Basic Science Teachers.

BSEPR: It consisted of three sections A, B, and C. Section A sought information on demographics such as qualification, year of experience and age. Section B sought information on the extent to which Basic Science curriculum at the JSS level emphasize the application of Basic Science Concepts to real life situations and development of the skills of the students. Each statement was placed on 4 point Likert scale of "To a very large extent", "To a large extent", "To some extent", and "Not at all". There were ten items under Section B and the reliability of the 10 items was 0.81 (Cronbach Alpha). Section C sought information on how teaching and learning of some topics (e.g. Simple Electric Circuits, Cells and Electricity; and Information and Communication Technology) in Basic Science, at JSS level, should be structured to help students develop skills to solve real life problems and generate wealth..

Procedures

The questionnaire was administered to the Basic Science Teachers in their schools. Ten postgraduate students at the Institute of Education, University of Ibadan, Nigeria, were engaged as research assistants. Each research assistant was assigned ten schools. In each school, all the Basic Science Teachers cooperated very well and the return rate of the questionnaire was about 97%.

Results

Results are presented in the order in which the research questions were stated.

Research Question One: To what extent does the Basic Science curriculum at the JSS level emphasise acquisition of skills, by the students, that can help reduce poverty in their immediate society? To assess the extent to which the Basic Science curriculum at the JSS level emphasise acquisition of skills, by the students, that can help reduce poverty in their immediate environment, teachers' responses to the ten items contained in SEPR were analysed.

Table 1 presents the results.

Table 1: Frequency and Percentages of Basic Science Teachers Responses

Statements		Responses				
To what extent does the Basic Science curriculum at the JSS level structured towards:		**LVE**	**LE**	**SE**	**NA**	**Mean**
1.	Reducing poverty in the society?	35 (9.4)	109 (29.4)	158 (42.6)	69 (18.6)	2.30
2.	Inculcating technical skills in the students?	90 (24.3)	108 (29.1)	133 (35.8)	40 (10.8)	2.67
3.	Developing creative skills of the students?	58 (15.6)	109 (29.4)	148 (39.9)	56 (15.1)	2.46
4.	Students' becoming self-reliant?	19 (5.1)	106 (28.6)	102 (27.5)	144 (38.8)	2.00
5.	Encouraging the students convert natural physical objects in their environment for wealth creation?	30 (8.1)	124 (33.4)	93 (25.1)	124 (33.4)	2.16
6.	Helping the students improving their health status?	24 (6.5)	131 (35.3)	98 (26.4)	118 (31.8)	2.16
7.	Encouraging the students improve their living conditions?	34 (9.2)	101 (27.2)	136 (36.7)	100 (27.0)	2.19
8.	Encouraging the students improve the living conditions of their parents?	35 (9.4)	109 (29.4)	158 (42.6)	69 (18.6)	2.30
9.	Promoting economic activities of the community of the students?	18 (4.9)	54 (14.6)	101 (27.2)	198 (53.3)	1.71
10.	Improving the traditional trade skills of the community of the students?	37 (10.0)	57 (15.4)	121 (32.6)	156 (42.0)	1.93

For the purpose of clarity in the interpretation of results, the responses under "Very Large Extent (VLE)" and "Large Extent (LE)" were collapsed. In addition, the mean of the responses to each item was determined and they as presented in the table. However, the mid-point of the four-response scale which was 2.5 was noted. This mid-point value was taken into consideration in the interpretation of the mean scores. Using the frequency and percentages of the responses and collapsing the VLE and LE, table 1 show that it is only in item 2 that more than average of the teachers indicated that the curriculum of Basic Science in the Junior School is structure towards inculcating technical skills in the students. That is when VLE and LE were collapsed, 217 (58.5%) of the teachers were of the opinion that Junior School Basic Science curriculum, as presently constituted, emphasise students' acquisition of technical skills that can help in poverty reduction. In all the other items, more than 50.0 % of the teachers were of the opinion that Junior School Basic Science curriculum, as presently constituted, does not emphasise students' acquisition of technical skills that can help in poverty reduction.

On the basis of the mean/mid-point, when the mid-point is less than 2.5, it suggests that majority of the teachers were of the opinion that the curriculum of the Junior School Basic Science, as presently constituted, does not adequately emphasize students' acquisition of skills that can help in poverty reduction. However, when the mid-point is greater than 2.5, it suggests that majority of the teachers were of the opinion that the curriculum of the Junior School Basic Science, as presently constituted, adequately emphasize students' acquisition of skills that can help in poverty reduction. From the table, the mean of each of the items except item 2, was below 2.5. Also, as the table shows, the overall mean of all the items was 2.19. This suggests that majority of the teachers were of the opinion that Junior School Basic Science curriculum, as presently constituted, does not emphasise students' acquisition of technical skills that can help in poverty reduction. An important question at this juncture is: How is Junior School Basic Science curriculum structured? An examination of the curriculum shows that more emphasis is placed on development of students' cognitive domain. Emphasis is more on acquisition of definitions of concepts, memorization of formulae and use of these formulae to calculate numerical problems. Less attention is paid to experimentations and problem solving activities.

For example, a cursory look at some of the topics in the Junior School Basic Science (e.g. Electricity, Simple Circuits, Work Energy, and Power and States of Matter) reveals that they were taught without adequate practical activities. More emphasis was on theory and development of the cognitive domain. This fact is reflected in some of the recommended textbooks for Basic Science at the Junior School level. The Oxford Advanced Learner's Dictionary (Hornby, 2010) defines science as knowledge and behavior of the natural and physical world based on facts one can prove, for example by experimentation. Science involves studying natural and physical problems found wherever we live and finding of answers to specific questions which we formulate as facts, concepts, theories and laws which are recorded and passed on to posterity. Thus science is an interwoven series of concepts, theories, facts and ideas that are developed as a result of experimentation. Therefore science education involves training the learner to observe the natural and physical environment, conduct experiments, analyse the results/observation and then interpret results. Arising from the definition of science, it is important to stress that if Nigeria and indeed other sub-Saharan countries wish to use science education to reduce poverty, the Junior School Basic Science curriculum should be structured in such a way that Science teachers will not be involved in telling the student the facts. Rather the emphasis will be the student teaching himself or herself. According to Masse (1965), in science, and even outside the classroom, this is the universal way of learning – that is the teacher should give the student the opportunity to teach himself or herself. Every scientist who has contributed to the growth of the society achieved the feat by teaching himself or herself. The great scientists learnt directly and indirectly from nature and they were able to contribute the development and growth of their environment by providing answers to problems they found in their environments.

Therefore the curriculum of Basic Science should emphasise student's independent learning and all the science teacher should do is to entice the students into teaching themselves, and when the teacher adroitly arrange circumstances so that they teach themselves, the students will learn. The students, in this process, are likely to develop creative, manipulative, survival and logical thinking skills that will help them create and develop materials that will be useful to the society, sellable and in the process create wealth for themselves. The question is: To what extent does Junior Basic Science curriculum emphasise these? These were the issues raised in this study. Unfortunately majority of the teachers sampled were of the opinion that it was to low extent. Research Question Two: How should teaching and learning of some topics in Basic Science, at JSS level, be structured to help students develop skills to solve real life problems and generate wealth. To answer this question, the teachers were asked to suggest how teaching and learning of some topics in Basic Science at the JSS level should be structured to help students develop technical and creative skills that can ultimately help them generate wealth and be more useful to their immediate environment. Among the major topics emphasized were electric circuits and Information and Communication Technology.

For Electric Circuits

Most of the teachers sampled (about 93%) were of the opinion that teaching and learning of electric circuits should be practical oriented. By this, the teachers emphasized the need for government both at the state and federal level to engage the services of artisans such radio and television repairers, electrical repairman, road side motor mechanics and workers of electricity distribution companies in the teaching and demonstration of real practical components of Basic Science. More importantly, the teachers emphasized the need for more assignments for the students in terms of projects. Although there is a school subject called Introductory Technology, emphasis should be on teaching the Basic Science and Introductory Technology as a single course with more emphasis on the practical/projects. That less emphasise should be placed on examinations that centers more on cognitive domain. That more weight should be given to practical/projects components in the termly or yearly assessments of students' learning outcomes in Basic Science The teachers were also of the opinion that students should be encouraged to develop electrical gadgets and apparatus that school can exhibit and further developed by companies. Some teachers recommended that students should be taught how to make less-energy consuming devices such as lightning bulbs, washing machines, and construction of small radio sets among others. The teachers were of the opinion that this can be achieved by making use of artisans such as radio and television repair men and electricians. The teachers also recommended that number of hours for Basic Science should be increased from the present two hours per week to three hours per week with the extra hour for real practical activities to be conducted by the invited artisans. In situations where the workshop of the artisans is not far from the school, the management should allow the students in the company of their teachers visit the workshops of these artisans and conduct the practical activities there.

Information and Communication Technology

No doubt the world is now a global village. Thanks to Information and Communication Technology (ICT). The teaching and learning of this topic should be aimed at helping students know how to source for information on diverse areas of life. There are many web sites that supply information about anything that one may wish to learn about. For example, there are sites through which students can learn about any of their school subjects (mathematics, Science, Geography, etc.). There are sites that give step by step activities for making electronic gadgets and other scientific apparatus and equipment, the curriculum should be structured towards encouraging the students to do independent search and make use of information they might gather from such sites. Students can even get information about happenings and inventions in other climes that can be useful to them and their immediate environment. Some of the teachers sampled were of the opinion that students should be taught how to actively use the Microsoft Word, Power point and EXCEL at least when they are in Junior Secondary School Three. With this they can generate some wealth themselves and be useful to their community.

Discussion and Conclusion

The results of this study have shown that the curriculum of Junior School Basic Science has not been structured towards adequately inculcating poverty reduction and sustainable economic values in junior secondary school students. These observations were made by the Basic Science teachers that were sampled. Having realized this, the teachers suggested how the curriculum should be structured and teaching and learning of topics such as Electricity Cells and Simple Circuits, and Information and Communication Technology should be conducted in Junior School's Basic Science. The need for integration and inculcation of poverty reduction education and economic values education in junior secondary school students was echoed earlier by Dania (2010) although his emphasis was in the area of social studies. Dania (2010) said "for a society like Nigeria where all the sectors of the economy are collapsing, there is an urgent need to reappraise the social terrain and the need to inculcate in the citizenry positive (poverty alleviation education and skills) values" geared at preparing the learner for sustainable living, adjustment to the harsh economic conditions and improvement of the dilapidated economy. On the basis of the results of this study and the suggestions of the teachers that were sampled, it will profit Nigeria if the Basic Science curriculum is enriched with poverty reduction contents and activities (more emphasis on practical activities and more frequent engagements of artisans to teach the practical courses, and emphasis on individual and joint projects for the students). In conclusion it is not an overstatement that science education is indispensable to economic development and poverty eradication. No economic development is possible without functional science education programme. A balanced science education system promotes not only economic development, but productivity, and generates individual income per capita. Its influence is noticeable at the micro level of an individual family whose combination makes up the nation.

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