

# REVIEW OF DEVELOPMENTS ON POLICIES ON THE ADVANCEMENT OF SCIENCE AND TECHNOLOGY EDUCATION IN SOME AFRICAN COUNTRIES

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## **Abstract**

*Science and technology education has been held as the indispensable means of social, economic and political progress. African nations were rated as developing because they are at the preliminary stage of science and technological knowhow. However they are untiringly making plausible efforts towards the acquisition of prominence in sound science and technological education. In this paper the efforts of various African nations in the provision of science education relevance to its economic capacity and social, political and economic demand is reviewed. It is generally deduced that the goals of science and technological education in Africa is centered on access, relevance and reformation of individuals and the society.*

The recognition of science and technology education as inevitable tool for national development and socio-economic advancement of any nation has today made the provision of science and technological education essential in various levels of learning in Africa. Spending a great expenditure on education is justified with the aim at the provision of sound and relevant science education. Various African countries have been modifying their science curriculum, institutional administration, and pedagogical strategies towards providing the caliber of science education that is relevant for socio-economic and technological advancement. It is generally felt that the sufferings in Africa is caused by a vacuum created by a poor science and technological education and unless this vacuum is filled the desire of having sustainable development, self reliance, and global adaptability in Africa is thought to remain a dream. Various African countries devised ways of filling this vacuum as they thought appropriate and this has lead to various policy formulations, plan actions, and implementations which are reflections of the need of these countries for science education. In this paper various developments in

science education in Africa are reviewed with a view to deduce similarities and difference in policies and implementation strategies.

## **Theoretical Framework**

### **Science and Technology Education in Cameroon**

Tambo (2003) reported that from independence in 1960 to 1998 education policy in Cameroon was dictated and guided by text regulations and many of them reflected the ideas of ministers and high state officials and lasted as long as the authors held power. The intensification of the need for relevant science education arose in 1984 Yaoundé declaration of the Pan African Congress on Education that held under the theme “What Type of Education For Africa In The Year 2000” called among other things the enrichment of teaching programs and the intensification of the teaching of science and technology (Kanjo 2009). Since then despite financial constraints various efforts were made for the provision of science education. Current policy on science education in Cameroon includes 1995 National Forum on Education. The forum made recommendations on the complete development of individuals’ personality and his participation on the development of his society. Its final recommendation pertaining science and technology education lead to the formulation of new objectives for secondary school education as follows:

- i. The school must contribute to render each individual capable of creativity, self employment, adapting at any time to the evolution of science and technology and to the changing demands of economic development.
- ii. The re-evaluation, rehabilitation, and adaptation of teaching methods, programs, and contents in line with the technological and cultural needs of Cameroon.
- iii. The continual education of teachers through regular programs of in-service training, distances learning, the promotion of the association of teachers of various subjects.
- iv. Summarily the type of man trained must be a patriotic citizen, enlightened, bilingual with cultural roots but open to the world, creative, enterprising, tolerant, proud of his society, and responsible, honest, respectful, of ideas of peace, solidarity and justice and possessing knowledge, knowhow and knowing how to live.

To achieve these aims the law number 98/004 stipulated among other things the restructuring of secondary education into 2 years for observation, 2 years for orientation (to grammar or technical) and 2 years (grammar or technical). And vocational training in technical schools organized in trades and linked to the ever evolving employment market. Also changes in the curriculum with the addition of new subjects like ICT, environmental, civic, health education, human rights etc. updated slimmed down programs adapted to modern technologies and more responsive to the education philosophy of Cameroon.

To this effect the following have been implemented in Cameroon.

- a. Practical/ experimental work in science and technology in all schools in the whole country.
- b. Construction and equipping of laboratories and workshops. Mandatory to reserve past registration fees for laboratory work expenses.
- c. Creation of Yaoundé d' excellence that imports micro-scientific kits for schools, researches and train teachers in science and mathematics experimentation.
- d. New grammar school program in science and technology with improved methodology and vocational components.
- e. Encouragement of the production of local text books.

On teacher education and welfare section 37-39 of the law focused on the teacher, designating him the principal guarantor of the capacity of education and holding him duty bound to teach, educate, provide educational guidance, promote the quest for scientific knowledge and carry out assessment. To help the teacher achieve these some initiatives were implanted which include:

- a. The creation of advanced teacher training college and advanced technical teachers' training college.
- b. New status for teachers' career profile to cater for the advancement and promotions to post of responsibilities.
- c. Creation of teachers' resource centers in all regions to encourage and supervise researches by teachers. It is hoped that with the achievement of these goals and implementation of these plans science and technological education in Cameroon can attain valuable position for the development of citizens and the nation.

It can thus be seen that science education in Cameroon is aimed at the reformation of the individual and the society through selected managerial strategies. This poses a deliberate modeling of educational policies towards the achievement of these goals.

### **Review on Current Policies on Post Basic Science Education in Gambia.**

Changes in policy concerning science and technology education in Gambia were stimulated by the increased observation in students' failure in Gambia Basic Education Certificate Examination (GEBECE). Kaddy (2009) posited that over the past three years standard in all aspects of teaching and learning science and technology in all levels of education have not been impressive. This made the directorate of science and technology to carry out a baseline survey in 2006 and the following points were identified:

- a. The existence of outdated pedagogical knowledge skills for teachers.
- b. Inadequate number of teaching/ learning materials and text books.

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- c. Students negative attitude towards mathematics and science.
- d. Lack of sufficient trained mathematics, science, and technology teachers.
- e. Low levels of English language skills.
- f. Problems with teacher' mastery of subject content.
- g. High teacher attrition rate of science and technology teachers.

To rectify these problems the following are currently adapted at basic level of education.

- a. Celebration of national science week annually to sensitize students on the role of science and technology on socio-economic development.
- b. Revision of mathematics, science and technology education curriculum.
- c. Development of teaching/learning materials (pupils text books and teachers guide).
- d. Retention allowance to science and technology teachers.
- e. In-service training for mathematics and science teachers.
- f. Integrated project-base learning in schools.

The government of Gambia is also in the process of developing a national science and technology policy which can act as a tool for the realization of the vision 2020 whose focus is to develop a scientifically and technologically literate population that would better support and generate the needed technology and environment to transform Gambia into an industrial manufacturing nation. To achieve this the Gambian department of basic and secondary education aims at popularizing science and technology by improving the status of science and technology education and infusing a scientific and technical culture in the society. This is done through improving science and technology education, developing science curriculum, integration of technology with science education, Information and Communication Technology (ICT) in schools, school science labs, science text books, management of science and technology teaching in schools, quality science text books, quality monitoring in science education, in-service training for science and technology teachers.

Gambia has thus identified the role of science teacher education in the provision of sound science education for national development. And most moves for the fortification of their science education are centered around the production of teachers with adequate knowledge of content and relevant pedagogical skills.

### **Science and Technology Education in Ghana**

Efforts for providing science education for national development in Ghana were highly demonstrated since 1995 with the attainment of independence the University of Science and Technology was established with the primary intention to churn out graduates in basic and applied science, engineering, pharmacy, medicine, and other science based disciplines (Aboagye 2009). Current efforts towards the provision of relevant science education for growth and sustainability in Ghana include developmental

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process in science and technology education in Ghana. To this effect changes in policy and implementation processes are made in various sections of education. In high (secondary) school science education is offered in the form of integrated science as a core course and admission into public and private universities, polytechnics, and teacher training colleges require mandatory pass in English, integrated science, and mathematics for all disciplines.

Technical and vocational education was also included in secondary education. This is offered in technical schools, secondary schools, vocational schools and training centers. This aimed at equipping the youth with the relevant technical and professional skills and experience to facilitate a rapid growth in Ghana's socio-economic development through self employment.

Reforms made in tertiary education system since 1991 include encouraging the establishment of more post-secondary institutions and in 2010 there were 38 public post secondary institutions in Ghana, 10 polytechnics, 8 public universities and several accredited private universities (Abagye 2009). Of the 8 public universities 6 are mandated to train scientists and technologists and the admission quota is 60:40 for science and humanities.

There was also the stipulation of the Ghana science and technology policy document. The cooperative decision of the ministry of environment, science and sports launched the science and technology policy document for Ghana in December 2000. the document outlined the objectives of science education for lifting Ghana to the level of middle income status by the year 2020 to be able to master scientific and technology capabilities to develop infrastructure which will enable industry and other sectors of the economy to provide the basic needs of society and citizenry, and to adopt a scientific and technology culture. This leads to the development of the National Science and Technology Education Policy. This document prepared in 2004 and revised in 2008 challenged science and technology education with the objective of orienting all levels of the country's' educational system to the teaching and learning of science and technology in order to accelerate the acculturation of science and technology in society, and to promote a critical mass of requisite human resources and well informed citizenry. The following policies are the strategies of the document:

- a. Strengthen science education at all levels in all aspects of the educational system especially at basic and secondary school levels.
- b. Promote technical and vocational education training to enhance middle level management in science and technology for all sectors.
- c. Promote innovativeness in science, technology and mathematics education.

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- d. Ensure that by the year 2015 60% of all students in the university and 80% of those in the polytechnics and vocational institutions are registered in science related disciplines.
- e. Create special incentives for students and graduates of science and technology.
- f. Ensure that adult literacy classes include studies into the cause and effect relations and how things work.
- g. Mobilize resources for science and technology development.

These strategies have been expanded to implementation strategies and framework to guide the realization of the set objectives. Despite financial constraints some measures taken to strengthen science and technology education in Ghana include:

- a. Establishment of Ghana education trust fund (GET Fund) in 2000 to generate funds to provide the financial needs of educational sectors. This assists in the provision of infrastructures like science labs, modern science equipments, training of science teachers, faculty researches and development etc
- b. Science resources / technical and vocational centers. Ghana education services (GES) established 110 well equipped science resource centers, laboratories and also provided buses for transporting students to such labs and centers. Also 20 technical/ vocational centers were setup throughout the country.

In addition a Science, Technology and Mathematics Education (STME) clinic was established for girls. Special teacher training colleges for science education were also established. Other efforts of boosting science and technology education in Ghana include the creation of teaching and learning innovation fund, science and technology fund and distance education. This shows that Ghana has a more diverse action plan on science education and this has to do with the diversification of the goals that Ghana vested on science education.

### **Science and Technology in Nigeria**

A number of studies suggested that Nigeria's low level of institutional capacity reduces its overall global competitiveness (World Bank report, 2008). Nigeria was ranked 101 out of 125 countries evaluated on the strength of their post basic education. To increase this competitiveness and better leverage Nigeria's' inherent resources, education must therefore be improved. Various problems were seen as threats to the success of the federal government Millennium Development Goals (MDG), National Economic Empowerment Development Strategy (NEEDS) and other education targeted goals. To rectify these problems the education system prioritized science and technology with policies that are favorably disposed to science education (Alebiosu and Ifamuyiwa, 2008). For this purpose the function of all agencies involved in the promotion of the study of science shall be adequately supported by the government. In addition government shall popularize the study of science and production of adequate number of scientists to inspire and support national development (FGN, 2004).

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Government has in various forms elucidated different policies on education that can help in moving this forward. The 2009 road map on education in April 2009 by the minister of education attempted to strengthen some policies or block certain loopholes as required for the improvement of science education. The National Policy on Science and Technology is revised from time to time and focuses more on national policies and programs, national policy on information technology and national policy on biotechnology (FMEST 2001). The Science and Technology Education Post-Basic Project (STEP-B) also contributed immensely to some of these issues. For instance in 2008 the STEP-B project developed a policy document with the help of some stake holders which defined certain national needs. Areas that need attention identified include:

1. Science, technology engineering and mathematics (STEM) education.
2. infectious and zoonotic diseases
3. food security studies
4. renewable energy
5. environmental protection and preservation
6. solid minerals research and development
7. advanced material science and manufacturing
8. soft ware engineering
9. chemical technology and cinematography
10. centers for biotechnology and genetic engineering

There has been a rapid development in the areas of Information and Communication Technology (ICT). The national board for technical education (NBTE) was mandated to promote and fund research and development in computer hardware, soft ware, firm ware, power systems, and related technologies. In addition the national university commission was also tasked with conducting research into and developing of computer hardware, soft ware and course work with the aim of enabling the country to participate in state of the art development in this area. Vocational and Innovative Enterprise Institution VEI are also involved by the FME to provide a broad based platform for the involvement of private sector in the provision of Technical and Vocational Education and Training (TVET) in the country. Apart from widening access to technical and vocational education training and serving the needs of industry and providing employability skills to youths and adults TVET also serves as the useful purpose of providing alternative to higher education.

From the above review it can be seen that Nigeria has centered attention on the modes of providing a sustainable strength in the provision of science education through designed sponsorship schemes. Funding is identified as an impending factor to the goals and objectives of science education in Nigeria so various projects are designed to

provide funding to ensure the achievement of educational goals especially as they relate to science and technological education.

### **Discussion and Conclusion**

The above review highlighted that emphasis of science and technology education in Africa is related to the following objectives:

1. Development of individuals' capacity and personality towards participation and development of his society.
2. Development of current and relevant pedagogical skills in science teachers.
3. Providing access to science education for the majority of African population.
4. Implementing stipulated policies on science and technology for socio-economic development of the society and individual.
5. Providing technical and scientific know how that will facilitate innovative thinking necessary for advancing the environment, local skills and solving every day challenges.
6. Increasing relevance and sustainability of science education policies, methods, and objectives in Africa.
7. Increasing the involvement of both genders in science and technology education and practice.
8. Cooperating with other ministries and NGO's in the provision of quality science education and the achievement of various objectives of science and technology education.

Although it can be easy to deduce the objectives of science and technology education in Africa it can be said that much time and emphasis was laid on policy formulation than on implementation. Although policies reviewed sound plausible and fruitful potentials for development it can be said that their cumbersome nature may contributed to failure in achievement of objectives and accessibility. Africa has tried to make projections towards development by making advanced visions but it is argued that the goals set are too broad for realizable achievement. This could lead to confusion in focus and consequently poor achievement in all policies and objectives. In addition many policies are not accompanied with a realizable implementation plan.

There could also be seen an inadequate involvement of the public in the implementation of educational policies. This is seen to be necessary for creating a sense of belonging to science and technology education and thus the public and government can be motivated to cater for their implementation. It was also observed that science and technology education was not given a socio-scientific approach. This could be a suitable alternative in the provision of relevant education for sustaining relevant innovative skills, and ideas, adaptability, appreciation of the society etc where poor technological skills in production for economic consumption prevail. Many problems of Africa can be

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solved by applying science to moral and social advancement than science to technological advancement.

### **Suggestions**

- i. Science and technology policies in Africa should select few realizable goals and objectives.
- ii. Policies made for the enhancement of science and technology in Africa should be accompanied with implementation action plan.
- iii. Science education implementation should demonstrate empirical assessable impact on the immediate African society.

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