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REFORMS IN SCIENCE, TECHNOLOGY AND MATHEMATICS (STEM) EDUCATION: A DIAGNOSTIC APPROACH

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Abstract

Change is said to be a difficult thing to do, not because it is difficult in itself but because the adaptability nature of man has made him to be comfortable most times with status quo regardless of the state of current practices. Reforms in science, technology and mathematics education is an inevitable thing to do owing to the fact that science is dynamic. In this article, the writer x-rayed some past educational reforms; with a view of finding out their setbacks, failures and major challenges associated with the reforms, which were detrimental to the achievement of the objectives underlining the reforms. Finally, constant appraisal of reform which must not be affected by change in government, minimum budgetary allocation for education by UNESCO should be adopted to meet funding requirements and qualified/quality teachers were among others recommended for meaningful educational reform and the attainment of educational goals and objectives.

Introduction

Reform in education is an inevitable development, especially in the field of science, technology and mathematics (STEM) education. This is evident in the fact that science is dynamic; as such all aspect of education that integrates science, technology and mathematics should not be static but must undergo periodic meaningful reforms, based on time and space and not on change of government. Change is said to be a difficult thing to do, not because it is difficult in itself but because the adaptability nature of man has made him to be comfortable most times with status quo regardless of the state of current practices. To achieve a meaningful educational reform, there is the need to x-ray past reforms with their corresponding lapses and successes if any, which will provide a guide to any reform being undertaken.

A review of reforms in primary education in Nigeria

Universal Primary Education (UPE)

The noticeable increase in Nigerian primary school enrollment in the 70s lead to the launching of the Universal Primary Education (UPE) scheme in September 1976. It marked the dawn of an educational revolution with pervasive social and economic implications. The political expectations were that UPE would enable the nation to overcome the hurdles caused by unbalanced educational and economic development which resulted in

Southern dominance and educational imbalances of urban opportunities over rural; and the preponderance of male over female enrollment in schools.

Despite the numerous advantages that could be derived from the programme, it failed as a result of underestimated projections of eligible children population, shortage of teachers, classrooms, equipment and infrastructures. The failure of UPE programme can be attributed to a number of factors namely: incorrect statistics, which lead to wrong population projections and faulty estimates of the needed resources, declining financial resources resulting from over dependence on oil as the sole revenue earner and poor planning of the programme.

Universal Basic Education (UBE)

Since 2004, efforts have been made to implement the UBE program not without some difficulties and challenges. In recent times, the 2004 UBE act has been reformed to emphasize basic 9 years compulsory education for all. The junior secondary school has been merged with primary school to make up the 9 years of compulsory continuous education.

The Universal Basic Education (UBE) Act of 2004 represents a significant educational reform, which addressed the lapses and loop holes of the UPE. The UBE was formulated to be the bed rock of a life-long learning that will impact reading, writing and the acquisition of other relevant skills for sustenance and development (Obiunu, 2011). One objective of the UBE was the provision of free and compulsory education for the first 9 years or levels of education beginning from the primary to the junior secondary school, and it is an inclusive education which seeks to embrace the formal and non formal settings of human development. For the policy to succeed there should be public enlightenment, social mobilization, teacher recruitment and training, provision of infrastructural facilities, review of the existing curriculum, adequate budgetary provision and basic education and skills acquisition programs.

Today, there is a growing body of research that is calling for reforms in the way science and technology is taught in schools (Lord, 2005, Travis and Lord 2004, Harwood, 2004, American Association for the Advancement of Science (AAAS), 1993, and Okebukola 2005). These reform efforts in Science education require a sustainable change in:

Curriculum Structure,
Quality of manpower,
Methodology/Content reduction,
Instructional materials and Assessment Techniques among others.

The mountain awareness of the importance of science and technology as the basic tools for sustainable development has made science educators to continually search for means to make teaching and learning of science very effective. Akinkugbe (2007) in Wasagu (2011) lamented that the developing world tend to be intellectually lazy blaming their inadequacies on the lack of expensive tools for research; and tend to forget that most of the major advances in the world were triggered by simple observations.

There is no doubt that over the years science education programs in Nigeria have raised more questions than answers. Nigeria is working on a system where the curriculum materials are irrelevant to the needs and aspiration of both students and society. It is reported (Okebukola 2005) that there is a widening gap between children's expectation of science classes and what they experience. In other words science teaching in schools is not producing the desired effect, and this calls for radical and pragmatic reform through the process approach in order to achieve desired results.

Dorayi (2007) in Wasagu (2011) opined that school curriculum of tertiary Institutions are not directly related to the needs of the society. Courses in scientific and technological fields do not have much relevance to the needs of industries and other productive sectors of the economy. This position is supported by Holbrook (2010) who sees school science learning as having an expectation of content acquisition with insufficient attention paid to the real education striving towards the goals of education and in so doing preparing students for the world beyond school.

Reforms in science, technology and mathematics (STM) Education

The world-wide reforms in science curriculum development which began in the united states of America found its way to Nigeria through the African Primary science progrmmes (APSP), Jegede, (1994). It was an integrated science project specifically designed for Africa, with its materials tailored towards the environmental approach aimed at evolving "a unique approach" to the teaching of science in Africa primary schools.

The Aiyetoro comprehensive high school, general science project started also in the sixties, which also provided a gateway for integrated science into Nigeria. These projects were later discontinued and in their place came the Nigeria integrated science Project (NISP) of Science Teachers

Association of Nigeria (STAN), which could claim the credit for establishing integrated science in all the corners of Nigeria.

To this end, Bajah (1991), define integrated science as an approach to teaching science in which concepts and principles are presented so as to express the fundamental unity of scientific thought and avoid premature or undue stress on the distinctions between the various scientific fields. The integrating principles of integrated science as delineated by Bajah are:

The course is relevant to learners needs and experience

Stress the fundamental unity of science.

Add a cultural dimension to the learning of science

Lays adequate and broad based foundation for subsequent specialist study

Respect both psychological and philosophical maturation of the learners.

The Basic Science and Technology Curriculum

The introduction of Basic Science and Technology in school curriculum implies an attempt for a radical change in emphasis and focus.

Innovation in Basic Primary and Junior Secondary Schools in Nigeria is characterized by features of the national core curriculum which is the incorporation of concept formation and process skills acquisition. The Nigerian Educational Research Development Council (NERDC) has recently scrapped integrated science and primary science and replaces it with Basic science and technology.

Primary science is now known as Basic Science and Technology. NERDC has also reviewed the curriculum:. The new science curriculum is meant for the first nine years of schooling, that is Primary one to six and Junior Secondary School one to three.

The essence of the new 9 year Basic Education Curriculum is to assure a well rounded education in terms of knowledge, skills, techniques and value needed to produce an individual who has been well educated and is able to compete favourably with his/her counterparts anywhere in the world. More specifically, the new 9 year Basic Education Curriculum if faithfully implemented is expected to equip the learners with the spirit of enquiring, intellectual manipulative and social value skills that will enable them generate jobs created wealth and eradicate poverty among others.

Importance of the new 9-year Basic Education Curriculum

Teachers agreed that the prescribed content of the 9-year Basic Education Curriculum are achievable.

Teachers agreed that the teachers and pupils/students activities in the 9-year Basic Education are achievable.

Pupils/students in Primary and Junior Secondary Schools have positive belief of achieving enquiry, intellectual, manipulative and societal value skills based on their achievement in the test batteries.

The Basic Education Curriculum contains content that emphasized enquiry intellectual, manipulative and societal values skills. (NERDC, 2009)

Challenges facing educational reforms

Reforms in education have suffered a lot of challenges, which were detrimental to the achievement of the objectives underlining the reforms. Some of these challenges include the following:

Availability of quality manpower: Quality is at the heart of education. Quality education is one that satisfies basic learning needs and enriches the lives of learners and their overall experience of living. The attainment of qualitative and progressive education, which some of these reforms emphasizes will largely depend on the availability of quality manpower. Number of teachers is still inadequate and many are discouraged with poor conditions of service.

Proper supervision: Lack of proper supervision of schools with regards to reforms implementation is one of the issues that posed big challenges to our educational reforms. Supervision of schools according to Edho, (2010) in Obiunu (2011) has to do with quality control of educational policies and programmes.

Functional Curriculum: Curriculum is also one of the challenges of educational reforms. According to Ajibola (2008) in Obiunu (2011) curriculum analysis on study shows that the learning experiences provided for the Nigerian child is rich and varied and has the capacity of meeting the immediate and future needs of the children. However, the curriculum of the Nigerian schools are over ambitious and over loaded.

Rising population: The noticeable explosion in Nigerian primary school enrollment, which led to the introduction of the UPE in 1976 has metamorphosised

into the current increase in demand for education and this does not commensurate with the facilities/infrastructures on ground.

Availability of teaching materials: According to Edho (2010) as quoted by Obiunu (2011), apart from problem of inadequate qualified teachers, there are also the problems of scars teaching materials and infrastructures. It is a recurrent issue in every educational reform program.

Proper policy implementation: Our educational reform program may not necessarily be short of proper and effective policy but to some extent policy implementation. In other words, Nigeria's education system should undergo periodic auditing of both programmes and institutions to ensure effective policy implementation.

Funding: Another challenge is that of funding. Poor funding has been a great challenge to educational reforms.

Recommendations

In view of the past setbacks, failures and challenges that marred an effective implementation and achievement of the objectives underlining reforms in education, I wish to recommend as follows:

Only qualified and quality manpower should be employed for the attainment of educational goals and objectives.

Government should put in place strong quality control measures on the educational policies and programs through effective supervision.

Reforms should not be targeted at content acquisition but qualitative education; striving towards the goals of education and should bridge the gap between children's expectation of science classes and what they experience.

There should be adequate statistical records of enrollment that will enable government to make proper provision for the growing demands for education.

Educational policies should constantly undergo appraisal with respect to quality of teachers, growing demand for education and the availability of educational resources.

The current reform should be carefully and effectively implemented with a periodic

appraisal of the program to achieve desired goals.

There is urgent need for increase funding of education in Nigeria. No meaningful educational reform can ever succeed without adequate funding.

Conclusion

The importance of science technology and mathematics education as basic tools for sustainable development cannot be overemphasized. If most of the major advances in the world were triggered by simple observation, which is the very first step in science process skills, then it is never too late to reform our educational system in such a manner as to advance for meaningful sustainable development.

References

American Association for the Advancement of Science, (1993): *Benchmark for Scientific Literacy*, New York, Oxford Press.

Bajah, S. T. (1991): *Rethinking Science Teacher Education in Nigeria:* A key note address at STAN Governing Council meeting held in Jos, Nigeria.

Buchaman's, S. A. (2004): Promoting Students learning in a large general chemistry course *Journal of College Science Teaching*. **33** (1): 12 – 17.

Harwood, W. S. (2004): A new model for enquiry. Is the Science Method divided. *Journal of College Science Teaching*, **33**: 29 – 33.

Holbrook, J. (2010): Evaluation through Science as a motivational Innovation for Science Education for all. *Science Education International*, **2** (2): 80 - 87.

Jegede, O.J. (1984). Non cognitive correlates of secondary school students achievement in Physics. *Journal of Science Teachers Association of Nigeria.* **22** (2): 78 – 87.

Lord, T. A. (2005). *Inquiry Based cooperative learning that works in College* Science. A Presentation at NSTA Convention in Dallas, U.S.A. March 31st-4th April NERDC (2009).

Obiunu J. J. (2011): *Teachers perception of the universal basic education programme as an Educational reform policy. The social sciences*, **6** (2): 150 – 154.

Okebukola, P. A. (2002): *Beyond the Stereotype to new trajectories in Science*

Teaching. Special lecture at 43rd Annual Conference of STAN held in Port Harcourt River State. Nigeria.

Okebukola, P. A. (2005): *Quality assurance in Teacher Education in Nigeria:* The roles of Faculties of Education. A paper at the Committee of Dean's of Education in Nigerian Universities, Abuja.

Travis, M. & Lord, F. A. (2004): Traditional and Constructive Teaching Technique, *Journal of College Science Tedy*, **34** (31): 12 – 14.

Wasagu, M. A. (2011): *Innovation in Science and Technology Education for the 21st Century: The Nigerian Experience.* Unpublished paper presented at RECSAM/ICASE Seminar at Pinang, Malaysia, 14 - 19 February, 2011.