

SCIENCE EDUCATION FOR NATIONAL DEVELOPMENT AND SCIENTIFIC CREATIVITY AMONG SECONDARY SCHOOL STUDENTS IN NIGERIA

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Abstract

This paper discussed science education for national development and scientific creativity among secondary school students in Nigeria. It examined the concepts of science education, scientific creativity and national development. It also highlighted the importance of science education to national development and strategies for enhancing scientific creativity development through science education in Nigeria. The paper recommended among others that Science teachers should adopt activity- oriented teaching strategies in teaching of secondary school science subjects in order to inculcate in the students the necessary skills and knowledge needed for scientific creativity and national development.

Key words: Science education, scientific creativity, national development, secondary school

Introduction

Education is the bedrock for human development. Education is one of the essential instruments which a nation uses to facilitate total enlightenment of its citizens and enhance all its socio-economic and political parameters for sustainable development. No wonder Okonkwo (2010) asserted that education is the fulcrum to which all other development revolves. This means that the management and planning of education must be given adequate consideration for any nation to advance rapidly. According to Uwazurike and Anokam in Obialor (2022), education is any act or experience that has a formative effect on the minds, character or physical ability of an individual. It is the act or process of impacting or acquiring knowledge, skills, values, belief and habits. It is also the aggregate of all the process by which children develop abilities, attitude and other forms of behaviour which are of the value to the society. This is why education is a formidable tool for man's survival and it also requires a top priority in the scheme of things among the comity of nations, Nigeria inclusive.

In Nigeria, the educational system is categorized into pre-primary schools, primary schools, secondary schools and tertiary education. Secondary school level which is also regarded as post-primary school education serves as a link between primary and tertiary education institutions. The goal of secondary school education is to prepare students for useful living within the society and higher education as stated in the National Policy on Education (Federal Republic of Nigeria (FRN), 2013). Without secondary school education, the foundation for any form of future academic aspirations cannot be laid. Secondary school education also consumes the products of primary schools and produce candidate for tertiary education in the nation (Abdulrahman, 2014).

Secondary school education in Nigeria is divided into junior secondary schools and senior secondary schools. The junior secondary school education is a form of education students attain after primary education while the senior secondary school is a three year educational system which students receive after the three years of junior secondary school before proceeding to the tertiary level of education. At both junior and senior secondary school levels, students are exposed to science education.

Science education is a gateway to the survival of a scientific and technological oriented- nation. Science education is a body of knowledge systematically arranged with scientific and technological themes and contents. It is the scholarly and practical discipline concerned with the teaching, learning and assessment of science content, science process as well as nature of science (Obialor, 2018). Science education is geared towards confronting issues that require scientific way of thinking for informed discussion, management and sharing of resources such as air, water and vegetation (Ellis, 2010). It also involves a systematic study of national phenomena and its study allows students to experience the richness and the excitement of natural world as they engage in inquiring, critical thinking and demonstration of skills. To develop these skills,

students ought to have the ability to apply the knowledge that they have learnt in science education to face challenges of life beyond school and one of the ways to achieve this is by enhancement of scientific creativity in all aspects of human life and development.

Scientific creativity is concerned with creative science experiments, creative scientific problems finding and solving. Scientific creativity depends on scientific knowledge and skills. According to Hadzigeorgious, Forkialia and Kabouropoulou (2012) described scientific creativity as the scientific activities employed by the science teacher in order to stimulate and encourage creative thinking among the students. National development is a continuous increase in all sectors of the economy and this increase is planned and implemented so that its results will become positive to the society. However, the development of any a nation depends on the development of science education and this is intricately linked with its emphasis on scientific creativity among the individuals or members of its nation. It is in line with the theory that countries such as UK, USA, France, Sweden, Australia, South Korea, Twaiman and Singapore see the need to foster scientific creativity through education particularly Science, Technology, Engineering and Mathematics education (Shaheen, 2010; Cheng, 2010). The ability of these countries to foster creativity through education have today made them to be among the most productive nations of the world with strong and self-relevant economy that enable them to serve leading roles in global competitiveness.

Conceptual Clarifications

Science Education

Science education is the study of science and how science and technology affects the society. It is the teaching and learning of science subjects in an undifferentiated manner which stresses the fundamental unity of science (Omiko in Obialor and Osuafor, 2019). Science education is a field of study concerned with producing a scientifically literate society. Omorogbe and Ewansiha (2013) added that Science education acquaints students with certain basic knowledge, skills and attitude needed for future work in science and science related fields. The authors further stated that the 21st century is characterized by advancement in science and technology and for Nigeria to realize accelerated development in the 21st century. There is need for quality science education in our schools. Madukwe (2018) maintained that the objectives of science education in Nigeria include the need to prepare students to observe and explore the environment, explain simple natural phenomena, develop scientific attitude including curiosity, critical reflection and objectivity, apply the skills and knowledge gained through science to solve everyday problems in the environment, develop self-confidence and self-reliance through problem solving activities in science.

Scientific Creativity

Scientific creativity according to Erodogen and Akkanat (2014) is said to depend on previous experiences and knowledge, sensitivity to problems and their solutions, understanding the nature

of the science and fascinating with it and development of new, extraordinary and useful scientific knowledge, experiments, theories and products. Hadzigeorgious, Forkialia and Kabouropoulou (2012) described scientific creativity as the scientific activities employed by the science teacher in order to stimulate and encourage creative thinking among the students. Scientific creativity is associated with some factors including problem solving, problem finding, formulating hypothesis, using analogy along with some personality factors such as motivation (Grosh, 2010). Scientific creativity requires sensitivity to problems because finding creative problem to solve is an important aspect of being a goal scientist. The researchers therefore see scientific creativity as acquisition of scientific skills and knowledge by an individual in order to enable him solve some creative problems and make intelligent decisions, contribute and hold educated opinions on matters that affect him.

National Development

National development, according to Egwu in Adeyera (2011) is the establishment of a viable and buoyant national economy, the establishment of a just and egalitarian society, the enthronement of equality and social justice and the building of a unified and integrated society where the different ethics, religious and geo-political identities develop a collective sense of imagination that they are one. In the same vein, national development, in the words of Emeh and Ogaboh in Okemakinde, Adewuyi and Alabi (2013) involves the total transformation of society making humanity the focus of the development drive and seeking to develop man's potentialities in a total sense. It includes reduction of poverty, wealth creation, equitable distribution of wealth, ensuring nutrition and health, housing and auxiliary services, social security and welfare. This presupposes that national development is an all embracing entity on the part of individual and societal change with such indications as quality food, gainful employment, and wealth creation, power reduction within the ambit of such framework as equality, dignity, social justice and equity (Emeh and Ogaboh in Okemakinde, Adewuyi & Alabi, 2013). Hence, a nation cannot be said to have developed when a significant percent of her population are not literate and there is decay in the country's educational system. In line with this thought, Opara, Onukwugha, Nwokeji and Mbah in Obialor (2018) opined that the need for quality human being with at least basic foundation of education which is quality and quantity, free and compulsory and its curriculum did not ignore all round development of individual or learner (Cognitive, affective and psychomotor). In addition, National Education Research Development Center (2008) asserted that the attainment of the objectives of Universal Basic Education will not be possible if functional curriculum capable of empowering the learners at the end of secondary school education is not available. This is why science education curriculum (i.e biology, chemistry, physics, mathematics, integrated science) accommodated the fundamentals of both National Economic Empowerment and Development Strategies (NEEDS) and the Millennium Development Goals (MDGS).

Importance of Science Education to National Development

Science education is very important to the development of any nation in many ways that is why nation must take it very serious in all institutions learning. Many of the developed worlds were able to achieve so much in science and technology because of science education. Launching of sputnik by the Russian government in October 4, 1957 would not have been possible if not for the position they place physics in science education.

In the area of agriculture, science and science education have taken the lead especially in the latest methods of agricultural production. Science education has provided us with the theoretical and practical knowledge of different methods of growing crops, protecting the crops and plants from insects and diseases and various ways of mechanized farming. Various agricultural institutions and research centers help both the agricultural scientists and students to research and discover new ways of improving food production and developing new varieties of food grains and fruits. Scientific education is equally striving in the area of farm animals. In this regard, keeping farm animals healthy and keeping man from the reach of some contagious animal diseases are of paramount importance of science education especially in the area of medical science which helps to keep farm animals and birds in good health.

Taking a glance at the scientific discoveries which emanated from science education and critical thinking, it is essential to note that the areas of transportation and communication are inclusive and cannot be left out. The construction, manufacturing and maintenance of ICT facilities, railway, air and sea transport, radio, television and telephone and so on are by-products of science education. Scientific education gave birth to modern medicine and hospital equipments and continues to look into the maintenance of both private and public health. Continuous study and research in advanced countries have resulted in the development of highly effective drugs and medicines that can cure most of the diseases. A country cannot protect its citizens from external aggression without military force and soldiers as we know need ammunitions. Hence, through science education modern warfare technologies and ammunitions are being produced to defend the country and its citizens and to remain prepared against foreign attacks. In fact, the whole structure of our civilization rests on the shoulders of scientific education and the benefits of science education cannot be over emphasized; take for instance, many graduates of biology education are self-employed and employers of labour, many owned schools for themselves where people work and earn their living while some are into fish business.

There are colleges of education where students of chemistry department are taught how to make dye and chalk, graduates of these departments can establish their own chalk business as soon as they graduate. If supported with fund many schools do not need to buy chalk outside anymore and they can equally produce for other schools.

Strategies of Enhancing Scientific Creativity Development through Science Education in Nigeria.

1. Adoption of Effective Teaching Strategies

Teaching strategies are essential to the success of the teaching and learning process. Teaching strategies influence acquisition of scientific skills, knowledge and concept during the learning process. Teaching strategies means a process of selecting, directing controlling and evaluating the experiences of the learners to achieve desirable outcome (Akinboye in Ekanem, 2006). Ekanem (2006) added that heuristic creativity and indirect teaching strategies can help the students to be creative, inventive, imaginative and original in their potential. Teaching strategies such as discovering teaching strategy is very vital in science learning. Akpan in Bash, Kabing, Dawal and Josiah (2019) opined that discovering activity is a lesson designed in such a way that the learners performs certain mental processes such as observing, classifying, measuring, predicting, describing and inferring. Discovery method creates an avenue in which science process skill could be put into consideration during science instruction. Laboratory teaching strategy provides the learners with the opportunity to practice cognitive skills such as ability to observe classify measure and interpreted date. However, activity- based strategies as discussed above should be embraced by science teachers. This would drastically ensure scientific creativity in science learning.

2. Provision of Teaching Resources

Science teachers require different kinds of teaching resources such as textbooks, apparatus, chemicals, charts, models, motion pictures as well as facilities such as laboratories to enhance the effectiveness of their instructions (Maundu, Muthwil and Sambili, 2005). A resource is any source of information, expertise, supply or support (Otieno, 2012). Resource materials play an important role in enhancing the teaching / learning process by modifying the teaching and learning situation, it helps in conveying the intended purpose. In line with this view, Bhagwan (2005) stated that a growing body of resources in the cognitive science suggest that students learn and better retain what they learned. Twoli (2006) maintained that in many countries including Nigeria, the school science curriculum is more of laboratory based and a large proportion of learning is spent on practical or hands-on-experience. The author further added that the practical sessions afford the students an opportunity to manipulate concrete objects, specimens, equipment and chemical under the guidance of the teacher. Moreso, Nderitu (2009) opined that most schools have rule that students are responsible for apparatus under their use and should any of the apparatus break during practical work, the student pay for the broken apparatus. In science, it is a known fact that most of the apparatus used in science subjects such as chemistry and physics are glass wares and most of which are expensive. Therefore, many students shy away from experiments due to this rule. The author therefore recommends a reversal of this rule for meaningful learning. Therefore, for scientific creativity to be embraced such rule should be avoided in science learning, since these apparatus are important tools in science teaching.

Conclusion

Science education is a novelty idea that is used to improve scientific creativity and national development in developing worlds. Such improvement brings about development that makes nation to be at par with the rest of the world. For this to be achievable in nation like Nigeria, the quality of teaching rendered to the learners by science teachers is very paramount. Thus, if teachers can make a paradigm shift in their pedagogy by making science teaching as much as possible practical oriented and not theoretical based. It is only then that the learners will acquire skills and knowledge needed for scientific creativity and development in Nigeria.

Recommendations

Based on the discussions, the following recommendations were made:

1. Science teachers should adopt activity- oriented teaching strategies in teaching of secondary school science subjects in order to inculcate in the students the necessary skills and knowledge needed for scientific creativity and national development.
2. Science teachers should advocate scientific creativity among the students by posing creative problem-solving activities to them.
3. Emphasis should be laid on science education as a fundamental educational tool that can enhance scientific creativity ability among the students and national development in Nigeria.
4. Government and stakeholders should provide enough funds so that schools may obtain enough teaching resources and equipment for effective teaching and learning of science subjects in Nigeria.

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