



Functional Integrated Science Education as a Tool for Wealth Creation Economic Diversification

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ABSTRACT

This paper looked at functional integrated science education as a tool for wealth creation and economic diversification. It clarifies the concept of functional education, integrated science education, wealth creation and economic diversification. It examined how functional science education could be used to create wealth and economic diversification by applying some innovative strategies and some of the challenges retarding the achievement of functional integrated science education in Nigerian schools. The paper concludes that Functional integrated Science Education has the potential of equipping individuals with life coping skills for self – reliance, Integrated Science curriculum should be made to be functional in terms of teaching resources, enough teachers in quantity and quality who are well motivated and good learning environment. The paper recommended that; regular workshops, seminars and conferences should be organized for teachers of Integrated Science to build their capacities for Integrating entrepreneurial skills in their teachings, there is the need for the country to have more emphasis on practical aspects of the subject so that studies in Integrated science may become more functional to individual as well as benefiting to the larger society among others.

Keywords: Functional education, integrated science, wealth creation and Economic diversification

INTRODUCTION

In today's world of global competition and complex problems, creative intelligence and innovative capacity are fast becoming requirements for personal and professional success (Christine *et al.*, 2017). The success of many nations in tackling major development problems such as poverty, unemployment, inequality among others can traced to their educational system (Kayode and Sunday, 2014). Education is the bedrock of the socio-economic and political development of any nation (UNDP, 2009). Among the important national educational

goals are: the inculcation of the right type of values and attitudes for the survival of the individual and the Nigerian society, and the acquisition of appropriate skills and the development of mental, physical and social abilities and competencies as equipment for the individual to live in and contribute to the development of the society (FRN, 2004). No nation can develop beyond its educational standard or level. Thus, education is seen as a catalyst for socio-economic and political development of a nation (Kayode and Sunday, 2014). Developed countries of the world like China, Japan, Russia, and United States of America among others have achieved various breakthroughs due to their commitment to ensuring a functional educational system in their countries (UNDP, 2009).

The perennial problems of poverty, unemployment, inequality among other have bedeviled every developmental effort in Nigeria. For instance, despite several efforts by successive governments in Nigeria through programmes and policy measures as well as the various intervention programmes and projects by Non-governmental organizations, and other foreign government agencies, it seem much has not been achieved in reducing the menace of poverty in the country as the rate of poverty is still on the high side (Onuba, 2012). Recent statistics from the National Bureau for Statistics (NBS), United Nations Development Programme (UNDP), and the World Bank still indicates that poverty incidence in Nigeria is over 60 percent (World Bank, 2004; UNDP, 2009).

Asaju *et al.* (2013) in their study concluded that the declining standard of education in Nigeria has affected its efforts at human resource development with great consequences for government efforts at reducing the high rate of poverty, unemployment, inequality which are attributed for other social ills experienced in the country today. Education should foster students to act creatively about ideas and issues across a range of disciplines. As creative thinkers they should explore alternatives. School programs need to be relevant, practical and comprehensive while interest and ability should determine the

individuals' direction in education for the acquisition of appropriate skills and competences (Udoh and Akpan, 2014).

The rising tide of unemployment in Nigeria has continued to haunt the youth and the labour force since Nigeria's economic fortunes changed for the worse in the late seventies. Unemployment rate in Nigeria stood at 23.9% in 2011. The National Bureau of Statistics (NBS) has put the figure of unemployed Nigerians in the first half of the year at 23.9%, up from 21.1% in 2010 and 19.7% in 2009. Nigeria's unemployment rate is spiraling upwards, growing at 11% yearly; youth un-employment rate being over 50%. This translates to a state of lack or poverty in the country (UNDP, 2009). Integrated science learning is a proper way to apply the essence of 21st-century learning. In integrated science learning, students are encouraged to connect the learning materials to real-world contexts. Students are involved actively in exploring the real-world contexts which one, the learning process can be implemented holistically, authentically, meaningfully, and actively (Wiyanto and Widiyat-moko, 2016). The need to restructure Integrated Science curriculum became imperative in the quest of reorientation, poverty eradication, job creation, and wealth generation using education to empower the people (Okoli and Onwuachu, 2009).

Conceptual Issues

Functional Education

Functional education is quite different from the concept of education. While Education simply refers to the process by which knowledge and skills are acquired, Functional Education is more encompassing, meaningful and most desirable. This is because it is the type of education that equips the recipient with the knowledge and skills needed for that performance of productive task. It is one that helps the society meet their developmental needs. These include among others the ability to express one self, to get a job and earn income commensurate with one's learning and abilities (Elomba, 2010).

The acquisition of creative skills prepares an individual for inventions and successful living in today's highly competitive world. This is what a functional education is meant or expected to achieve. The teacher is expected to play a major role in developing the creative potential of pupils and students to prepare them for future meaningful living (Tim, 2017). It is an education that comes from the child's needs and uses the child's interest as a mechanism for activating his and towards his desirable activities. The purpose is to develop the life of the mind that acts from the wholeness of organic life in the present and in the future (Otuka, 2016). To Obanya in Abraham (2012) it is that education which comes from the child's need, and the uses the child's interests as a mechanism for activating him towards his desirable activities. Education should be geared towards preparing people to undertake specific tasks and employment functions essentials in the transformation of society (Otuka, 2016).

Integrated Science Education

Integrated science is defined as a cumulative approach of scientific study that synthesizes the perspectives of the individual disciplines, and integrates them during all phases of the approach to a question or problem, with the results having an influence on policy and management decisions (Gallagher *et. al.*, 2008). It plays a significant role in the lives of individuals and the development of a nation scientifically and technologically (Alebiosu and Ifamu-yiwa, 2008). This has contributed towards promoting scientific literacy for decades, and therefore, in the current science and technology dominated society, scientific literacy is considered as an important goal of science education. Interdisciplinary Science is a degree that specifically tackles problems needing input from more than one scientific field. Problems are not presented as separate single subject tasks but instead is tackled using a cross-discipline approach drawing on knowledge from experts in the field. Science itself is not fragmentary and the developments in modern science show the interdisciplinary nature of science. For instance, during the course of learning integrated science, students will be exposed to concepts in biology, chemistry, astronomy, geography,

physics, etc., and when they come across such 'hybrid' subjects as biophysics, geophysics, biochemistry, astrophysics, geochemistry etc., they will be able to recall and demonstrate some understanding of what is involved (Afuwape, 2004).

Integrated science education therefore, the process of training and instruction, design to develop knowledge, insight, attitude, values and skills that are adapted to particular functions or used in a nations' quest for development. Integration in science can help students to gain a strengthening of an understanding of the role and function of science in everyday life and the world in which they live. With integrated science learning, learning is closer to life. In specific terms, the Integrated Science curriculum aims broadly at developing life copying skills such as problem solving, communication, critical thinking and rational reasoning, to enable learners prepare for work place and self-sustainability in the world economy, (NERDC, 2007). In other words, science learning should be integrated from those sub-discipline contents. One basic competence has been integrating the science concepts of the sub-discipline of physics, biology, chemistry, and earth science and space (Pratiwiand Muslim, 2016). In addition, in science development framework, scientific competence is connected to daily life, technology, and environment. The curriculum prescribes the use of guided inquiry method of teaching and learning in order to promote learning by doing and skills development. In addition, a new theme "Science and development" was added to expose learners to developments in science and technology alongside skills that will enable them to take challenges, make informed decisions, develop survival strategies, and learn to live effectively within the global community(Sunhaji,2013).

Integration in the curriculum could result in increased functionality, greater intellectual curiosity, improve attitude, enhance problem-solving skills, and heighten achievement. Moreover, they are trained to discover the concepts by themselves holistically, meaningfully, authentically, and actively (Wiyanto and Widiyatmoko, 2016).The

stated objectives of the Integrated Science curriculum are to enable learners to:

Wealth Creation

Wealth creation is the process of investing in different asset classes where the investments will help in fulfilling key needs. These investments should also be self-contained that can generate a stable source of income, helping one to fulfill their aspirations. No one really knows what the future holds for them. Hence, it is better to start planning for the future from the beginning. Starting investments early will help in creating wealth in the long term. Short term investments will not always create wealth. Therefore, wealth creation as an investment strategy plays a significant role. There is no doubt that Nigeria is endowed with enormous human and natural resources. As rightly observed by Matthew-Daniel (2013), human and natural resources endowment are not enough for wealth creation and economic development of any nation, but the knowledge of how these raw materials can be transformed into valuable goods and services for economic development and improved quality of life. This therefore means that wealth creation is a product of imaginative and creative ability of individuals who utilize the available material resources to maximize gain and social life satisfaction which cannot be achieved without economic diversification.

Economic Diversification

Nigeria as a nation at present time is in a great need of redirecting her educational policies towards diversifying her economies across the various sectors of the economy by adopting functional education in such areas as agriculture, commerce, manufacturing industries, tourism, mining, transportation, education sectors, and health among others. There are a lot opportunities abound in above areas where entrepreneurship education, science education, agricultural education, mathematics education and Information and Communication Technology education can be applied. The list is in exhaustive. According to (Zagros, 2016), A diversified economy is an economy

that has a number of different revenue streams and provides nations with the capacity for sustainable growth leading to development because of non-reliance on one particular type of revenue source. Economic diversification is imbedded in what is known as economic complexity, which is the idea that countries should not be dependent upon a small number of products for their economic livelihoods (Onodugo, Amujiri and Nwuba, 2015). Diversification thus, provides nations with the security and reliability so that if one economic revenue stream fails, they have several other options for revenue generation. For example, a country that has an economy based predominantly on oil production is neither particularly complex nor economically diverse.

Functionality of Integrated science Education in Enhancing Wealth Creation and Economic Diversification

The major reason for unemployment, and the attendant social vices, among Nigerian youths have been identified as lack of productive and marketable skills on the part of the unemployed which can be arrested through the combined application of science, technology and vocational education. Many of the school leavers are not adequately prepared to fit into the productive sector of the economy and cannot therefore provide the services that can generate sustainable income (Yakubu, 2012). Modern science education holds the key to the rapid transformation of Nigeria. The Nigerian economy is one of the most developed economies in Africa (EWC, 2010). Integrated science involves various activities. These include project work, demonstration, lecturing, individual practical work, small group discussion, visits to museum or zoos, building models, explaining phenomena to students and a host of other verbal and non-verbal activities. The choice of approach depends on several factors, one of which is the object of the activity. The teacher should be made acquainted with all these and allowed to use the appropriate ones instead of being restricted to certain strategies recommended by the curriculum in order to develop skills needed for wealth creation and economic diversification.

However, the following innovative teaching methods could be used in teaching integrated science to develop functional skills necessary for wealth creation and economic diversification

Project Method

Project method is one of the modern method of teaching. It is based on the philosophy and the principle of 'Learning by doing'. In this strategy pupils perform constructive activities in natural condition. It demands work from the pupils (Al-Rawi, 2013). No doubt a comatose economy like we are in Nigeria can use the above mentioned and creative approaches to enhance the teaching of Integrated science in Nigeria with a view of improving productivity and wealth creation

The Guided Discovery Strategy

This is an innovative way of teaching integrated science. It enables the students to find answers themselves. A change usually occurs in students' learning when they are actively involved in the learning process. Apparatus has to be set up and result of the investigation awaited (Barron, and Chen, 2008).

Activity-Based Method

Is a technique adopted by a teacher to emphasize his or her method of teaching through activity in which the students participate rigorously and bring about efficient learning experiences. It means any learning that is carried out with a purpose in a social environment, involving physical and mental action, stimulating for creative action or expression (Apedoe, *et al.*, 2006). Activity based teaching strategies describes a range of pedagogical approaches to teaching. Its core premises include the requirement that learning should be based on doing some hands on experiments and activities. It enhances creative aspect of experience, it gives reality for learning, Move the student to reluctance to exercise and respect for manual labor and lead to the strengthening of the independence.

Field Trip

One of the strategies of teaching integrated science is by taking students to the field to provide first-hand experience of organisms in their environment. Such experiences are not available within the confines of the laboratory. According to Akubilo (2010) field-trip is a method of teaching that involves taking the students on an excursion outside the classroom for the purpose of making relevant observation necessary for understanding of the topic under study. It enables student to obtain scientific, technological and vocational information (Okolo, 2014). It also help students to discover and explore new information and apply/organize previous knowledge by giving concrete examples. Field trips are aids the teacher uses to arouse the interest of the learner thereby enabling the learner to gain direct experience (Ilori, 2010).

Problem-Solving Method

It involves overcoming obstacles by generating hypotheses, testing those predictions, and arriving at satisfactory solutions. It involves three basic functions: Seeking information, Generating new knowledge and Making decisions (Sharma, 2006). It presupposes that students can take on some of the responsibility for their own learning and can take personal action to solve problems, resolve conflicts, discuss alternatives, and focus on thinking as a vital element of the curriculum. It provides students with opportunities to use their newly acquired knowledge in meaningful, real-life activities and assists them in working at higher levels of thinking (Barron, and Chen, 2008). Problem solving method develops skill of finding solutions to the problem on their own. The students thinking on problem and their understanding of the science behind anything helps them to solve problems of their life objectively.

Laboratory Activities

The laboratories are important in fostering understanding of certain aspects of the nature of science, in promoting intellectual and conceptual development and particularly, in developing positive

attitudes towards science. It seems to be an important ingredient in the development of certain problem-solving skills. Learning through laboratory strategy extends and reinforces theoretical learning through reality. It is often said that nature is the grand teacher of integrated science (McKee, *et al.*, 2007). Thus, this method is psychologically sound as it satisfies the natural urge for activity. Different skills are developed. It paves way for exploration experimentation and verification of scientific facts and principles (Al-Rawi, 2013).

Demonstration Method

When using the demonstration model in the classroom, the teacher, or some other expert on the topic being taught, performs the tasks step-by-step so that the learner will eventually be able to complete the same task independently. For example, a science teacher may teach an idea by performing an experiment for students. A demonstration may be used to prove a fact through a combination of visual evidence and associated reasoning (Al-Rawi, 2013). The eventual goal is for learners to not only duplicate the task, but to recognize how to problem-solve when unexpected obstacles or problems arise. After performing the demonstration, the teacher's role becomes supporting students in their attempts, providing guidance and feedback, and offering suggestions for alternative approaches (McKee *et al.*, 2007). The bringing together and inculcation of the above can provide the necessary skills to our pupils/students. The world of works is very vast, complex and demanding and emphasized the need to expose pupils at the basic level of education through simple and concrete science process skills of science rather than concentrating on their products.

Problems retarding the Achievement of Functional Integrated science Education in our Schools

Efforts to making Integrated Science education functional is often met with a number of Challenges, these include the following;

1. **Large Classes.** Large class size has been identified as a major constraint to functionalizing integrated Science Education. In many schools, the class size is 60 students or even more. Under such circumstances, it is

difficult to use learner-Centered and activity – based participatory teaching approaches. The consequence is that the intended desired process skills are not acquired. The national policy recommended pupil to teacher ratio of 40:1. This is hardly implemented.

2. **Teacher Factors.** One of the most outstanding problems in Nigeria achieving functional education is the inadequate production of qualified teaching staff for the subject. Teachers had traditionally been trained in one or two of the science subjects. On the other hand, integrated science curricula for schools embrace biology, chemistry, earth science, physics and agriculture. Teachers therefore feel insecure to teach aspects of the curricula which are unfamiliar to them. It is the classroom teacher that implements the curriculum. Ineffective teacher is a well-trained, motivated and well equipped to do his job. In addition, the teacher is not motivated in term of remuneration, working tools, welfare packages, working environment and social esteem. This of course underscores the importance of quality teachers in the system. This no doubt could affect quality teaching in a comatose economy.

3. **Assessment Procedures.** The system of assessment in the country is dysfunctional. It is expected that teachers should give projects to students as part of assessment and students could then use those projects to learn the skills – this is hardly done. Science practical are not usually organized. This explains why students in most schools enter the science laboratory for the first time when list of requirements for practical examinations are released by WAEC. The JSCE in Basic Science does not even incorporate practical aspect in its examination. What is required for a functional integrated Science is performance based assessment.

4. **Poor Funding.** Education in Nigeria and Science education in particular has suffered severe under funding. The UNESCO's recommendation for a minimum of 26% of the budgetary allocation to education is yet to see the light of the day. The effect is that classrooms are lacking instructional materials.

5. **Corruption and insecurity challenges** are also major challenges that can affect creativity and functionality. Corruptions are monies meant

for the education sector that are diverted to private pockets. This has created problems such as poverty and unemployment in our national lives. According to Shishima(2017), other ills associated with corruption include social vices such as cultism, commercial sex, drug abuse, human/drug trafficking, kidnapping and so on.

6. Deficiency of instructional materials and poorly equipped laboratories are also challenges that could affect creativity and functionality in a comatose economy as it relates to integrated science teaching. The subject requires enough fund for purchase of instructional materials and well equipped laboratories. If such is lacking, no meaningful studies could be carried out and hence low productivity.

CONCLUSION

From the foregoing, it is evident that, Functional integrated Science Education has the potential of equipping individuals with life coping skills and self – reliance. An individual who is properly schooled in Integrated Science should be creative in his thinking and would be able to see opportunities where others have over looked. Such an individual will possess the attitudes and skills to be able to be self – reliant. Therefore, in order for Nigeria to make one of the twenty great world economies, integrated Science curriculum should be made to be functional in terms of teaching resources, enough teachers in quantity and quality who are well motivated, good learning environment and integrated science laboratories. If this is done, there are high hopes that those who are exposed to Basic Science programme would have been equipped to re-direct our country's small scale enterprise coalition necessary to propel the nation's economy.

Recommendations

In order that the Integrated Science Education curriculum is made functional for effective enhancement of wealth creation and economic diversification, the following recommendations were made.

- Regular workshops, seminars and conferences should be organized for teachers of integrated Science to build their capacities for

integrating entrepreneurial skills in their teachings. The Science Teachers Association of Nigeria, (STAN) and such similar organizations could be of help in this regard.

- Assessment methods and processes should emphasize performance based assessment so as to ascertain the acquisition of the right type of skills.
- More teachers should be employed so as to reduce the student – teacher ratio to acceptable level. Those already employed should be motivated
- Integrated Science laboratories should be provided and equipped to foster activity based learning.
- There should be a proper budgetary allocation for the educational sector. Funds should be channeled to each institution and proper managing of funds must be ensured by the government. The abysmal low level of allocation to the education sector must be reversed. Curriculum load should be reviewed
- Government, private, corporate organizations, non-governmental organizations and individuals should as a matter of due responsibility encourage and finance research programs, inventions and mass production of invented products.
- There is the need for the country to have more emphasis on practical aspects of the subject so that studies in integrated science may become more functional to individual as well as benefiting to the larger society.

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