Sustainable Development in Science and Technology Using Primary Education Mathematics

By

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Abstract

Mathematics is the key, mathematics is the pillar and mathematics is the bedrock and cornerstone of every science subjects. It starts from the cradle and that is where the tap root is formed without effective teaching of mathematics at the primary level, the future is bleak, this therefore, buttress the importance of instructional materials for effective teaching of mathematics in the primary school and the need for teachers to vary their methods of teaching mathematics as a core and compulsory subject. Science, technology and mathematics (STM) constitute the bedrock of development of any nation. The level of sustainable development of any society depends on the level of STM education acquired and applied to the society. This paper therefore focuses on the importance of mathematics, science and technology as a veritable tool for sustainable development. The paper highlights the challenges of teaching mathematics and also proffered solutions and recommendation.

Keywords: Sustainable, development, science, technology, primary education and mathematics

Introduction

Mathematics has continued to play a significant role in the national development of any country. Development is conceived as the capacity of a nation to apply technology for the exploitation of natural resources. Such exploitation will rely heavily on mathematics for laying the foundation for scientific and technological

advancement. It is a well-known issue that mathematics, science and technology influence man in all aspects of life including feeding, communication, healthcare as well as transportation. The national and global economy is looked upon to rightly depend on mathematics education.

The importance accorded mathematics in the school curriculum from primary to the secondary levels reflects accurately the vital role played by the subject in contemporary society. Teachers of mathematics should therefore employ all means in making sure that mathematics received effective teaching and learning at all levels of the educational system through the development and implementation of innovative programmes and projects. In most schools in Nigeria, the study of mathematics is made compulsory for all students. In order to secure admission for most courses at higher levels of education, a credit pass in mathematics is a pre-requisite. It is therefore worthy to note that primary education mathematics prepares the youth for the increasing scientific and technological world where citizens will need to learn and apply knowledge to solve real world problems (Obiechina, 2017).

Meaning of Mathematics

Mathematic could be said to be the study of patterns and relationship which can be expressed in symbols. It embraces many important ideas about numbers and space which involves problem-solving and a very powerful way of communication (Nwana, 2019).

According to Odili (2006) mathematics is the science of quantity and space. It is a systematized, organized and exact branch of science. It is a creation of human mind concerned primarily with ideas, process and reasoning. Therefore, mathematics can be seen variously as a body of knowledge, a collection of techniques and methods, the product of human activity and even as the activity itself, namely, the solving of problem.

Why should Pupils Study Mathematics?

The National Policy on Education (2004) hopes by inculcating the following values….. faith in man's ability to make rational decisions. Mathematics education is a worthwhile pursuit based on its intrinsic value. The ability of man to reason;

logically and think critically is one of the marks of an educated man. So, the study of mathematics could be an end in itself.

Every individual in the society must have knowledge of mathematics so as to become useful and effective member of the society. The role mathematics plays towards the economic development of our society cannot be overemphasized. No society can develop in one way or the other without effective practicing the application of mathematics. Mathematics is the bedrock of science and technology and also language of communication which formed the basic foundation for scientific, technological, political stability and enhanced security in Nigeria (Ogbugh, 2014). One of the objectives of teaching mathematics as provided in the National Policy on Education (2004) is the provision of meaningful and relevant knowledge and ability to apply scientific knowledge to everyday life. The knowledge acquired from the primary stage formed the basis for mathematics related courses, such as, Engineering, medicine, biochemistry, microbiology and computer science (Odili, 2006).

Teachers of Mathematics

There is need for a mathematics teacher to be able to deliver his/her lesson to meet the needs of the learners irrespective of their individual differences which can be age, family background, level of intelligent, socio-economic environment and others (Ohuche, 2016). The content of mathematics have developed a package of computer simulation and multi-media teaching which is an indication that the teaching and learning has gone beyond their conventional approach (class teaching method) into the use of simulation teaching for primary school pupils, which is the area of interest as far as this study is concerned (Adeniran, 2013).

The role of teachers is very vital in the implementation of curriculum, his target is to ensure that the pupils achieve national goals. Since the old and popular conventional (class teaching) Method of teaching mathematics is outdated and cannot meet the contents understanding level of the pupils due to ages, home background and computer age. It is imperative to know that, before a teacher can achieve the objective of any lesson, it is expected that the materials and method of instruction should be easily transferable to the real world. Therefore, it is a must that a teacher of mathematics should teach with instructional materials and teach

from known to unknown, simple to complex to aid learning and meet the expectation of the leaners. Basically, instructional material stimulates or arouses the pupil's interest, simplifies and makes instruction real and interesting. Therefore, pupils must be provided with things to see, touch and handle. There should be an adequate provision of concrete materials in the classroom, without it, the subject will become very abstract. Actual objects have an appeal for the young stars. Most children need the help of concrete materials to accompany their thinking. Its when you comprehend that you can be able to apply (Gershenfield, 2015).

As a mathematics teacher, you should adopt the three stages of teaching new topics in mathematics.

- The stage for concrete materials and demonstration of real life situation.
- The stage of pictorial studies
- The stage of abstraction

Application of the three stages in teaching distance and length measures.

Stage 1 – using concrete materials, you should start by comparing the following:

i. Pupils notebooks with either their exercise books or textbooks and ask which is longer?
ii. Pen and pencil - which is longer?
iii. Pegs of different sides, doors and windows, chalkboard, ruler and pupils ruler, pupil's height

In doing this, you are not interested in knowing the actual value of the difference in height yet, but for now, it is all a matter of visual impression and judgment by sight (Nwanna, 2019).

Stage II – Using Pictures.

Some primary mathematics textbooks have good visual expressions which you can easily tap. You can compare such pictures in terms of height or side of objects in pairs or groups. You can also ask pupils to shape the longer/shorter ones. In this way, through perception pupils will appreciate the visual differences in length, heights and distance, this time, not through pictorial symbols which is a preparatory step to the use of materials for denoting lengths or distances. It is

important that children be taught how to read from pictures and answer questions on them or be able to draw funny pictures of their own to represent what they have in mind.

Note that, pictures and diagrams do attract small children and the concentration they have on the pictures do help the pupils in learning.

Stage III – Abstraction

At this stage, pupils could be asked to write down their results in correct notations and the appropriate table for lengths will be build up using the conventional notations. This may be followed by many exercises in comparing lengths and distance by merely looking at numbers from measurement and later learn to add, subtract divide and multiply. Thus, mathematics at the primary school level should be that of doing, talking, writing, manipulating objects and experimenting with them (Nwana, 2019).

Mathematics in Human Activities

One cannot avoid considering the utilitarian aspect of mathematics in preparing a pupils for a useful living: counting, notation, addition, subtraction, multiplication, division, weighing, measuring, selling, buying are some simple and fundamental processes of mathematics which have got an immense practical value in life. Every person, on finishing primary education, should have clear ideas of numbers and a comprehension of both the very large and the very small. He should understand the way number is applied to measures like length, volume, weight, area, speed and ratio. Estimation and approximation will help check economic waste in everyday life. The economy of modern living and the technology of modern selling require a housewife to be able to estimate quickly which of two different price offers, sizes or measures is the better buy and to be able to see through many of the tricks of the trade (Ale, 2004).

A necessary condition for a happy life is the art of economical living. Economy in the matter of money is not enough; a person has to be economical in every single act of his life. Economy in the case of time is most valuable. Mathematics is a very suitable subject for inculcating the spirit of economy. It deals with economy in time, money, speech and thought and is bound to develop the corresponding

attitudes in the individual. The learning of the art of economical living is a byproduct of the learning of mathematics (Chronicle, 2009). The mathematics class will expose the pupil to the experience of representing three dimensional objects on a flat piece of paper by a variety of techniques and he will understand the concepts of ratio and proportion. The study of mathematics, therefore will go a long way to equip pupils to live effectively in our modern age of science and technology (Bell, 2009).

Strategies for Teaching Primary School Mathematics

- know your pupils and your resources
- Recap prior learning
- Share lesson objective to improve maths progress
- Teach key maths vocabulary
- Personalize learning and link questions to pupil's interest
- Create more opportunities for pupil talk
- Use teaching aids or visual
- Use variation to improve maths progress
- Vary approaches to questions
- Encourage metacognitive to encourage maths progress
- Reward, praise and encourage the pupils
- Give meaningful and frequent homework (Ebo, 2022)

Concept of Sustainable Development

According to Wilken (2008) sustainable development that is characterized by equity and that is socially responsive to the problem of poverty and inequality between classes, communities and nations. It advocates for development that account for ecological and environmental balance to avoid development today at expense of tomorrow, in ensuring that technological, economic and social development does not compromise human needs today and of the future.

The concept of sustainable development was first recognized and used in 1980 by the international; union for the conservation in nature (IUCN) in the world conservation strategy. He stated further that the link between the environment and development (INCDE) redefined the concept. Thus, as defined by the INCDE, sustainable development was conceived as "meeting the needs of the present

generation without compromising the needs of the future generation". Sustainable development should address the needs and aspiration of th present and the future on a continuous basis (Ezema, 2004).

Science, Technology and Mathematics (STM) for Sustainable Development

Education is the key that unlocks the door to modern development. How easily, or how this door is opened depends on the appropriateness of the key (Sani, 2019). The most appropriate key in this age of science and technology is necessarily STM education. The importance of STM education has been realized not only by the citizenry, but also by our rulers and leaders – political, socio-economic, academic and even traditional. Educational programmes must, therefore include elements of science and technological skill. These had led to the revisitation of science curriculum and the introduction of science, technology and mathematics (STM education into the Nigeria school system (Ayogu, 2008).

The purpose of STM education in Nigeria as derived from the National Education Objectives of the National Policy on Education (FRN 2004) includes:

> The inculcation of national consciousness and national unity. The inculcation of the right type of values and attitudes for the survival of the individual and Nigeria society. The training of the mind in the understanding of the world around him. The acquisition of appropriate skills and the development of the mental, physical and social abilities and competencies as equipment for the development of the society.

Science, technology and mathematics prepares individuals, to be job creators and not job seekers and is aimed at providing the learners with adequate knowledge at the primary ;level on how to set up his or her own business which makes them to be self-employed and independence. As well as effective tools for solving economic problems in Nigeria and combating insecurity in the Nation (Janlil, 2019).

STM as a primary school subjects play a vital role in today's modern world. The development, growth and technological progression of all nation are a function of the strength of its effective teaching and learning of STM to pupils. It is the foundation of technology, economy and industrialization of any country. The

importance of STM education to Nigeria cannot be overemphasized and no degree of concentration paid to it at primary level will be excessively much. This is because it has direct and indirect effects on each sector of development. It is the fundamental knowledge acquired in mathematics at primary school that leads to development of interest of learners in science and technology related courses at higher level of education (Ayogu, 2008).

The application of scientific knowledge acquired in mathematics, as reported by Adeniran (2013) helped many countries like China and India to transform from poor Feudal economies to industrial powers and are competing with developed countries. Early experiences in mathematics help learners to develop problem solving skills that empower them to participate in an increasingly scientific and technological world (Adeniran, 2013).

According to Elechi (2021), STM is a subject that provide unique training to learner in observation, reasoning and experiment in the different branches of Science. It also helps learner to develop a logical mind. It enables learners to be systematics in carrying out activities and an objective judgment. When taught according to its philosophy, it equips learners with the necessary introductory scientific and technological knowledge and skills necessary to build a progressive society. This forms the bedrock on which National development rest.

Challenges of STM

Successful implementation and performance in STM allows pupils to acquire basic information and talents in science and technology. This is the beginning of technological development and growth of that Nation, Nigeria inclusive. However, despite STM's enormous significance to the country at large, the following challenges hinder its successful implementation (Adeyemo, 2010).

Teacher Learner Ratio Problem

This is a major challenge facing the teaching of STM in Nigeria since the inception of UBE for free and compulsory education. According to the National Policy on Education (2014), the teacher pupils ratio should be 1:35 but this is contrary to what is observed in Nigerian schools today. Overcrowding of classes has adverse effect on curriculum implementation.

Lack of Instructional Materials

The instructional materials such as laboratories, equipped workshops and libraries needed by teachers for easy understanding by the learners are grossly inadequate. The availability and use of instructional materials have major impact on learner performance.

Inadequate Funding

Funding is one of the greatest challenges facing the education sector of Nigeria. The achievement of any educational policy and curriculum depend mainly on financial support. Insufficient financial support from government and others hamper the provision of well-grounded and qualitative system of education.

Learner's Attitude Towards STM Subjects

Lack of interest in mathematics and science subjects is one of the major challenges that hinder pupil's effective learning. Pupils develop negative attitude towards mathematics and this is a great challenge to the prospect of science and technology.

Attitude of Teachers' towards Teaching Mathematics

This syndrome of teacher per class in primary school impede learning. Some of the teachers did not know mathematics and they are teaching the wrong thing. Some teachers cannot teach science subject effectively. In some situations, teachers are not dedicated and therefore frustrate the pupils.

Lack of Motivation

STM teachers are not satisfactorily motivated compared to their contributions in education. These pose a very big challenge to the system because the teachers are always looking for a way to leave the profession for other greener pastures. It is sad to note that teachers' salaries are not adequate and not paid on time. They also do not enjoy regular promotions as at when due.

Inadequate resources

Qualitative primary STM education can only be provided where there is the availability of human resources (Okpala, 2007)

Conclusion

Science, technology and mathematics are vital to development of any nation. Education, programmes are believed to afford the pupils the right skills, knowledge and competencies needed for them to take their positions as useful citizen and members of the society. Thus, the aim of Nigeria education at all levels, especially primary education level should be to produce graduates who have the skills to use their heads and hands to provide job for themselves, employ others and also create wealth. Hence, to achieve this, there is the need to fortify all the primary institutions of learning to expose the pupils to various mathematical scientific and technological skills that will help them to be self-employed, to acquire skills for daily creative living through logical thinking and problem solving, reduce unemployment by generating employment through self-sufficiency, reduce insecurity and poverty in the nation at large. Science technology and mathematics, has always played an indispensable role in shaping the economic realities of any society, they are extra-ordinary opportunities that are inter-connected and engaged in the impartation of competencies required for sustainable national development.

Recommendations

Based on the discussion above, the following recommendations were made:

i. The government should ensure that laboratories, mathematics science and technology equipment is provided so as to encourage teaching of the subject in Primary schools.
ii. Teachers of mathematics, science and technology should teach with enough instructional material and improvise where necessary.
iii. Teacher-per-class should be replaced by subject teachers in the primary school for effective delivery.
iv. There should be regular and timely workshops and seminars for mathematics and science teachers to keep them on track and enable them discharge their duties to the pupils.
v. Sufficient time should be allocated to mathematics, science and technology lesson so as to enable teachers give their best and also cover their syllabus for profitability of the pupils.

vi. Although, there is a popular saying that teachers reward is in heaven, the government should ensure good welfare packages for them to make them happy and put smiles on their faces.

vii. Government should employ qualified teachers to teach mathematics, science and technology effectively.

viii. Special scholarship scheme should be given to all learners that agree to take up mathematics and science based courses in the universities.

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