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# Mathematics Teaching as a Fundamental Tool for Self-Reliance and National Development

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Abstract

Mathematics teaching is an interaction between the teacher and the learners that leads to acquisition of desirable mathematical knowledge, ideas and skill. These mathematical ideas, knowledge and skills form the basic essential tools for human and national independence. This paper therefore discusses the concept of self-reliance, the concept of National development, the concept of Mathematics teaching, problems and prospects of Mathematics teaching, branches of Mathematics and its relevance, and finally Mathematics as a fundamental tool for self-reliance and national development. It was concluded that the essence of teaching Mathematics for self-reliance is to promote responsible citizens towards national development. Therefore, it was recommended amongst others that Mathematics teachers should endeavor to relate Mathematics concepts to real life situations.

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## 1. Introduction

In the development of nations, Mathematics plays a vital role. Mathematics is a science of magnitude and number as well as the science that sustains the daily practices of man. It is the only core science subject that acts as pivot on which national development and wealth of any nation is created. Aguele and Agwagah (2007) observes that without Mathematics there is no science, without science there is no modern technology and without modern technology there is no modern society. In other words, Mathematics is the precursor and the queen of science and technology and the indispensable single element in modern societal development. So, if any nation must be self-reliant and develop, the teaching of Mathematics should be given adequate attention in the various levels of her education.

However, Mathematics education is the foundation of science and technology without which a nation can never become prosperous and economically independent (Anumudu, n.d.). This implies that the level of social and economic development is closely connected with the level of development in the Mathematics education. No society can develop without the effective teaching and learning of Mathematics in schools (Azuka, 2015). Therefore, Mathematics education is vital to a nations development, particularly due to its contributions to the training of manpower in the fundamental basics of science and technology as vital tools useful in every sphere of life. The fabric of society has become more and more underpinned by mathematical ideas. As a result, a major development in Mathematics education in this millennium has been the increased amount of Mathematics that all citizens are expected to know. Technological leaders and political leaders need Mathematics education that takes into account both the new uses of Mathematics and technology and new ways in which Mathematics can be done with information technology. Wherever a person belongs in a society, he utilizes knowledge of Mathematics in one form or the other. The president of a nation, an engineer, a businessman, an industrialist, a banker and a financer or a finance minister; a planner or a boss in a parastatal, even a labourer has to calculate his wages make purchases from the market and adjust the expenditure to his income. Whosoever earns and spends uses Mathematics. Counting, notation, addition, subtraction, multiplication, division, weighing, measuring, selling, buying and many more are simple and fundamental processes of Mathematics which require immense practice. The knowledge and skills in these processes can be provided in an effective and systematic manner only by teaching Mathematics appropriately in schools (Tali, Mbwas Abe, 2012). Despite its utility, Mathematics has been one of the subjects which Nigerian students especially at secondary schools level develop dislike for and likewise perform poorly (Odili, 2006). The big question is, what can be done to improve the teaching and learning of Mathematics in Nigerian School system being a tool for self-reliance and sustainable

development? Tali, Mbwas and Abe (2012) stated that the more knowledge of mathematical concepts with the corresponding knowledge of their application to real life seems to be deteriorating. To develop scientifically, technologically, economically and politically, largely depends on the manpower the country has acquired. This man power includes the Mathematics teachers, engineers, medical doctors, technologist and others. In order to produce future scientist and technologists in quality and quantity that are self-reliant, the knowledge of Mathematics is paramount (Tali, Mbwas Abe, 2012). However, students and people frequently ask these questions; How can the teaching and learning of Mathematics be improved in our schools as a tool for self-reliance? What importance is Mathematics in achieving national development? Therefore this paper discusses the concept of self-reliance, the concept of Mathematics teaching, problems and prospects of Mathematics teaching, Mathematics: its branches and uses, and Mathematics as a fundamental tool for self reliance and national development.

**The Concept Self-Reliance:** Selfreliance is seen as being able to do or decide things by oneself rather than depending on others for help or assistance (Oxford Advanced Learners Dictionary, 2001). The Oxford African Encyclopedia for Schools and Colleges (1974) stated that a self-reliant person performs independently to achieve his pre-determined goals. Therefore self-reliance is seen as being able to do, decide things and act independently to achieve predetermined objective. Self-reliance is vital to the independent and development of a nation because no nation can develop without being self-reliant. For instance, the developed nations like America, Japan, Germany and China are self-reliant, while the underdeveloped and developing nations are not self-reliant which make them to depend on the developed nations for survival.

**The Concept National Development:** When national development is mentioned, there is the tendency for one to equate it with economic development. National development is not synonymous with economic development rather it is a part or dimension of total development of the society. According to Achimugu (2000), it is the extent to which a nation is able to overcome her complex socioeconomic, political and cultural issues to ensure progressive changes in the quality of life of all her citizens. National development can also be defined as a continuous improvement of material and human resources of a nation in order to maximize and manipulate the physical environment for the benefit of the citizenry. To this extent, national development connotes improvement in the living standard of each citizen. It is necessary to mention that personal development is the starting point for societal development. This notwithstanding there are shapes known problems that have been a clog in the wheel of development in Nigeria. These obstacles are low gross national product, low level of technological development,

low standard of living, very low level of industrialization, low per capita income, high level of unemployment and under employment, dependence on agriculture that is not even mechanized. Others are low quality of education, lack of capital for investment as well as lack of skilled manpower, near absence of social amenities, political instability, high mortality rate as a result of poor nutrition and poor medical services, leadership incompetence, corruption, inequality and general poverty are also present in Nigeria Anumudu (n.d.). Some of the elements of national development include high standard of living, high agricultural productivity, high technological productivity, adequate exploration and exploitation of the natural and mineral resources of the society, less dependence on imported materials, presence of heavy industries, high literacy and numeracy rate of the citizens, appropriate health care delivery and low unemployment. Every society aspires to develop and achieve a better standard of living for her citizens and this is only possible with the presence of well trained technologists who can help to transform the society. Therefore, the under development of Nigeria could be readily traced to her lack of economic independence which in turn arise from her backwardness in science and technology (Azuka, 2015).

**The concept of mathematics teaching:** Mathematics is a branch of knowledge that deals with measurement, numbers and quantities. Mathematics is a tool, its knowledge and skills are the bedrock of all societal transformation and transfer of ideas into reality. Each of the diverse branches of Mathematics has useful applications on which fields of human endeavor hangs (Abubakar, Wokoma Afebuame 2012). Competency in Mathematics teaching and learning is vital and sustainable to every individuals meaningful and productive life (Unodiaku, 2013). According to Tali, Mbwas and Abe (2012), teaching is an activity which enables pupils or learners to learn and acquire the described knowledge, skills and disposition necessary for becoming functional members of the society. It as a series of interaction between the teacher and the learners with the explicit goal of changing one or more of the learners cognitive or effective states. Moreover, Oladosu (2004) viewed teaching as an activity aimed at bringing about meaningful learning through a method that is morally and pedagogically accepted. It involves a teacher; a learner; a content in form of knowledge, facts, information and skills to be imparted; a deliberate intention on the part of the teacher to teach for learning and on the part of the learner to learn; and finally a method that respect the leaners cognitive integrity and freedom of choice. Therefore, Mathematics teaching can be seen as the interaction between the teacher and the learners to acquire the described mathematical knowledge, skills, and ideas necessary for becoming functional members of the society.

**Problems and Prospects of Mathematics Teaching in Nigeria Secondary Schools:** In spite of governments effort on the development of Mathematics teaching and provision of opportunities for the improvement of teaching, there are still problems of Mathematics teaching and learning. Tali, Mbwas and Abe (2012)outlined some of these problems as follows:

1. inadequate curriculum integration;
2. shortage of professionally qualified teachers;
3. inadequate of instructional materials;
4. poor government policy;
5. poor classroom organisation by teachers;
6. lack of equipped Mathematics laboratory for practical;
7. over population of students which may impedes effective demonstration during practical;
8. teachers impatience and un-preparedness;
9. poor remuneration of teachers.

Based on the numerous achievements recorded in Mathematics education in Nigeria in the 21st century, there are more challenges ahead of Mathematics teaching. There have been efforts in Mathematics curriculum development to correct these problems, but there appears to be more challenges in Mathematics teaching and learning as summarised:

i. With the establishment of more institutions and efforts of ministries of education, there is possibility of improving Mathematics teachers supply in the near future.

ii. With the knowledge of Mathematics, sciences and technology, and in particular the Mathematics application to the development of the society is the centre piece of essence of Engineers, Technicians and Scientists clubs, and national competitions to stimulate creativity, improvisation, interest in Mathematics and technology, and productive work in and out of school.

iii. There would be the need to teach the students the applications of each branches of Mathematics alongside the teaching of the content, so the teaching of Mathematics could be more effective and learners would appreciate the importance of Mathematics to individual and national development.

**Mathematics, Its Branches and Relevance:** Mathematics is quite rich in concepts which directly translate to proper life skills. The importance of Mathematics education to self-reliance and national development cannot be over emphasized. The production of technicians and technologists in any society depends on the level of the study of Mathematics in the society. Hence, it has been asserted that the gap in the level of development between the advanced countries and the developing countries is as a result of the gap in the level of the teaching

and learning of Mathematics (Azuka, 2012). The richness of Mathematics is evident in each branch as follows:

MATHEMATICS

| Branches of Mathematics | Relevance |
|---|---|
| Mathematics Education | The practice of teaching & learning Mathematics along with problem solving techniques and issues relating to curriculum |
| Practical Mathematics | Arithmetic, elementary algebra, plane and solid geometry |
| Trigonometry | Cover measuring degrees, equations and formulae essential to equip for trade or craft |
| Abstract and Mathematics concept | Involves set and functions |
| Euclidean Geometry | Number Theory: branch of pure Mathematics concerned with the properties of numbers in general and integers called higher Arithmetic |
| Geometry | Involves Mathematics concerned with questions of size, shapes, relative position of figures and with properties of space |
| Heirustics and other problem solving strategies | To solve non-routine problems |
| Combinatorics | The Mathematics of counting |
| Probability | Mathematics of chance, quantification of our rational belief, Mathematics structures used to model pairwise relations between objects from a certain collection for studying shortest route path |
| Financial Mathematics | Application of Mathematics model to solve problems of finance |
| Mechanics | concerned with behavior of physical bodies when subjected to forces or displacement & subsequent effect of the bodies on their environment |
| Calculus | problems which algebra alone cannot be sufficiently build on algebra, trigonometry, analytic geometry and includes two major branches differential and integral calculus |
| Commercial Mathematics | Mathematics of accounts, Profit and loss |
| Graph Theory | Mathematics of connection in networks and study of graphs |

Source: Abubakar *et. al.* 2012.

**Mathematics as a Fundamental Tool for Self-Reliance and National Development:** Any developing nation like Nigeria needs to be self-reliant for its development. According to Anumudu (n. d.), the usefulness of Mathematics in all fields that is needed for self-reliance and national development is highlighted below:

**Science and Technology:** Mathematics has been the back bone of several human endeavours notably science and technology, and this is the life wire of national development. It has advanced so much that what is left for man to attain is the creation of man itself. There is no doubt that technology has brought higher standard of living to people both in advanced countries and developing nations. It is the rising living standard that makes the acquisition of technical competence so attractive to those countries. Today, the products of science and technology are glaring and enjoyable. The invention of satellite, the mobile phones, the high security gadgets etc are the products of science and technology. In Nigeria, science and technology have been applied in many spheres especially in the oil industry.
Mathematics is an instrument for fostering scientific and technological advancement. The usefulness of Mathematics to the ordinary man is its ability to develop his reasoning faculty to the extent of modifying man's pattern of reasoning. Hence, the knowledge of geometry and trigonometry are most rapid in architecture, surveying, building, modeling, sculpturing and medicine, which consists major parts of national development. Internationally, the computer usage worldwide was made possible because of the knowledge of Mathematics. Computer is a facilitative technology and merely allows those who are already doing something to do more of it faster and more accurately.

**Business and Industry:** Quantitative techniques, which are aspect of Mathematics are those statistical and operations research or programming techniques, which help in the decision-making process especially concerning business and industry. They involve the use of numbers, symbols and other mathematical expressions. Some of the important operations research techniques often used these days in business and industry are as here under explained:

(1) Linear programme:This technique is used in finding a solution for optimising a given objective such as profit maximization or cost minimization under certain constraints.

(2) Game theory: is used to determine the optimum strategy in a competitive situation.

(3) Decision theory: It concerns with making sound decision under condition of certainty, risk and uncertainty

(4) Network analysis: This involves the determination of an optimum sequence of performing certain operations concerning some jobs in order to increase over time and/ or cost.

(5) Simulation: This is a technique of testing a model, which resembles a real life situation and several other techniques.

All these techniques are not simple but involve higher Mathematics. The tendency today is to combine several of these techniques and form into more sophisticated and advance programming models. All these are aspects of national development. A lot of mathematical knowledge is used in modern industries in determining which models of machine (s) would produce greater materials at a maximum profit within minimum time. This phenomenon was demonstrated by Hicks (1955).

**Entrepreneurial Skills:** There is the need for Nigeria youths to develop entrepreneurial skills especially in this modern age where not up to 30percent of graduate youths are gainfully employed. The roles of Mathematics as a self-reliant tool in being successful in entrepreneurship are:

1. basic Mathematics knowledge is essential to set-up meaningful business outfits viable enough to stand the test of time. For instance in becoming a successful carpenter or tailor, accuracy and precision in measurement which is an essential element in Mathematics would be the cardinal skills for excellence.

2. an entrepreneur needs the knowledge of Mathematics to plan and execute his business effectively. The skill of estimation approximation and even projection are very crucial for effectiveness in routine business activities.

3. the knowledge of Mathematics is essential for sorting and classification of products, deciding demand and supply, taking business stock, skilled service delivery and determining business progress;

4. with the knowledge of Mathematics, an entrepreneur can keep records of expenditure. Book-keeping is very crucial and important in any business activity, using various Mathematics tools e.g. percentages help to clearly identify the progress being made and prompt action for modification in strategy as the case may be.

Moreover, Alio and Anaeche (2014) identified the following ways as strategies by which young graduates of Mathematics educators could become self-reliant:

- developing centres for the production of materials for mathematical games;
- writing and marketing Mathematics textbooks;
- establishing private schools for self-reliance;
- developing centres for the production of Mathematics teaching resources;
- consultancy services in Mathematics education.

**Other Areas:** In banks, basic knowledge of Mathematics is needed for effective and efficient transaction between the bankers and their customers. Good knowledge of basic Mathematics is essential for the manipulation of building blocks into dams, construction, machines and structures. Indeed without quality education system which is rooted in Mathematics we invariably have unimaginative and unpatriotic engineers with roads that wash away after the first rains; doctors that kill more than they can cure, pharmacists that can mix inappropriate drugs that can kill thousands. Of course the cumulative effect would be non-development rather than development, and at times national retrogression instead of progression and development. Mathematical concepts are general ideals that first become apparent in one area and readily being transferred to another. Examples include new development in Knot theory, arising from mathematical physics and applied to molecular biology, a musical problem whose solution has illuminated the theory of waves, an optimisation problem that has led to fundamental questions about computability, and a new kind of geometry that originated in classical mechanics and is now of central importance in quantum physics.
Federal Government of Nigeria in the National Policy on Education (2013) made Mathematics compulsory for both primary and secondary school curriculum. It is also needed in every level of education. Over 90% of the courses in Nigerian universities, Mathematics is an admission prerequisite. Even after graduation, employers demand good performance in selection aptitude tests. Such tests have heavy dose of Mathematics. As we can see, like a person's shadow, Mathematics is applied to every human activity, and virtually every profession expresses some degree of numeracy. Mathematics is used in arts, business, commerce, law, medicine, politics, religion, sociology, war and so on, Since man cannot do without the basic ingredients for survival, coupled with the elementary fact that Mathematics is the core ingredient of all these, man must as a matter of necessity, learn, understand and apply the language of Mathematics to sustain and maintain his existence. From the foregoing, the contributions of Mathematics to other subjects and hence to everyday life towards self-reliance and national development could be seen.

**Conclusion and Recommendations:** Teaching of Mathematics for self-reliance and national development implies making the learners see Mathematics beyond the classroom boundaries. It means that learners must be brought to the real world of issues and relate the Mathematics they learned to the realities of life. The essence of teaching Mathematics for self-reliance is to promote responsible citizens towards national development.
Based on this, the following recommendations are made:

1) Mathematics teachers should endeavor to relate Mathematics concepts to real life situations.

2) Government should employ more Mathematics teachers and supply adequate instructional materials and equip Mathematics laboratory for effective teaching and learning of Mathematics in Nigerian schools.

3) Mathematics and Mathematics education graduates should be able to utilize the knowledge acquired to take good decisions for their self-reliance and self-survival in the society.

4) Mathematics curriculum planners should ensure that, there is proper integration of the curriculum in all schools in Nigeria.

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