

THE ROLE OF MATHEMATICS IN THE DEVELOPMENT OF SCIENCE & TECHNOLOGY IN NIGERIA IN THE 21ST CENTURY

Orngudwem, Terfa Iyorshe¹, Atindiga, Simon Terhemem¹ and Kper, Bartholomew
Torkuma²

¹Basic Science Department, Akperan Orshi College of Agriculture, Yandev-Benue State

²ICT Directorate, Akperan Orshi College of Agriculture, Yandev P.M.B. 181, Gboko-Benue State,
agriculture4truelife@gmail.com

ABSTRACT

The Nigerian government requires mathematics that can effectively put science and technology in the forefront of Nation building. This paper reviewed the role of mathematics in science and technology and the nature of mathematics that would facilitate the realization of this development. The challenges of mathematics in the 21st century were highlighted. The paper recommends amongst others, the employment of highly qualified and competent mathematics teachers and organization of regular capacity building workshops/professional development programmes for mathematics teachers.

Keywords: Mathematics, Development, Science and Technology, Nigeria.

INTRODUCTION

Mathematics has come a long way to stay in Nigeria. Before the introduction of formal education, mathematics was used mainly in taking stock of daily farming and trading activities by the traditional society. Most of the traditional societies had their number systems which were either in base two, five or twenty. This could be seen in their markets days and system of counting. However, with the introduction of the western education in Nigeria by the missionaries, mathematics occupied a central position in the school curriculum. This

has remained its position in the Nigerian system of education today. This has taken care of the introduction of the 6 – 3 – 3 – 4 system of education. In the system, mathematics is a core subject at all levels of education. The relevant position occupied by the subject in the school curricula is borne out of the role of mathematics in scientific and technological development, a veritable tool in nation building. Mathematics is widely regarded as the language of science and technology^[1]. Mathematics is a science of methods by which quantities sought are deducible from others known or supposed. Anyone who neglects mathematics may not go far in science and in fact other areas of human endeavour.

^[2] Stated that while science is the bedrock that provides the spring board for the growth of technology, mathematics is the gate and key to the science. ^[3] acknowledged the importance and contribution of mathematics to the modern culture of science and technology, stating that without mathematics there is no science, and without science there is no modern technology and without modern technology, development will be a problem and there will be no modern society. Mathematics is the king and queen of science and technology and the indispensable single element in modern societal development ^[4].

Since the introduction of formal education in Nigeria, mathematics has gone through several developments. These transformations have always been necessitated by the realization of the role mathematics play in nation's scientific and technological development and response to societal needs and wants ^[5]. The world today is considered a global village—the era which has brought a lot of sophistication in mathematics to be able to sustain these developments.

Science and Technology

Mathematics is the foundation of science and technology. ^[6] professed that mathematics is the language of science and technology hence prioritization of mathematics teaching and learning in the bid for National development is inevitable. Mathematics is the basic requirement in all subjects at all levels of learning. Mathematics is needed in Integrated Science, Physics, Chemistry, Biology, and Engineering courses which lead to technology. Countries like Japan, Taiwan, Singapore, South Korea, China and India are recognized due to their Science and Technology and Innovation (STI) which had driven performance.

^[7] opined that scientific knowledge is fundamental to addressing the critical issues of economic transformation and globalization, reduction of unemployment, poverty, hunger and disease and the sustainable use of natural resources facing the world today. ^[8] also corroborated that mathematic as indispensable tool for technological development communicates the idea of post harvest management emanating from practical application of science.

Mathematics in Agriculture

Agriculture can be defined as the tradition, the art, science and technology of cultivating, multiplying, nurturing and sustaining productivity of biological (plant, animal and aquatic) life for the ultimate purpose of providing nourishment and sustenance of human life and existence on planet earth ^[9]. Agriculture provides the Nation with food essential for the nutritional development of a Nation. The number of crops to be planted, amount of fertilizers to be used in ratio is estimated using numbers. The planting of root and tree crops

involves determination of the dimensions and spacing between each crop, and the numbers of crops and the required plot it will take for its proper propagation is mathematically calculated. Knowing the actual quantity of chemical which will induce the hatching of eggs to fingerlings and the capacity of fingerlings that each pond will contain depends on mathematical knowledge ^[8]. Harvest are recorded using numbers, Rainy/Dry season are predicted using probability. Animals in livestock farms are recorded using numbers; chickens feeds are measured using kilogram and ratio of chickens to the feed. Ratio is used to share tractors to agriculture rich states as well as fertilizers. This in all will improve national food security.

Mathematics in Nation Building

Today it is a reality that the creation, mastery and utilization of modern science and technology tools have basically distinguished the so called developing and the developed nations of the world. That is to say that the standard of living of a nation is dependent on its level of science and technology. While science is the bedrock that provides the spring board for the growth of technology, Mathematics is the gate and key to the science. It is the level of mathematics that determines the level of the science and technological competence of any nation. The foundation of science and technology, which is the basic requirement for development of a nation, is mathematics. This shows the importance of mathematics in nation building.

Mathematics as opined by ^[2], is the major tool available for formulating theories in sciences and other fields. It is used in explaining observation and experiments in other field of inquiry. ^[10] observed earlier that there is hardly any area of science that does not

make use of mathematical concepts to explain its own concepts, theories or models.

Mathematics today is having an enormous impact on science and society. The influence may be silent and appear hidden but has shaped the world in many ways. Mathematical ideas have helped make possible the revolution in electronics which has transformed the way we think and live today. The Information Technology (IT) of today has transformed the world into a global village. These advances in science and technology are made possible by the numerous developments in pure and applied mathematics. Mathematical sciences have helped improve the ability to predict weather conditions; measure the effects of environmental hazards; project the outcomes of electrons etc. Mathematical methods, structures and concepts have become indispensable to the functioning of the technological society. Indeed in this period of hi-technology and internet super highways, no nation can make any meaningful achievement, particularly in economic development, without technology whose foundation is science and mathematics.

In this present age of science and technology, the achievement of any meaningful economic development must be largely dependent on science and technology, which is also dependent on mathematics. ^[3] opined that improved scientific knowledge and the availability of technology whether indigenous, will certainly increase economic productivity and viability. However, the state of science and technology is a function of development and application of mathematics. Reference could be made to the ever-growing mathematical concepts and systems that are being applied effectively for the service of man.

Today mathematics in its various forms has found applications in economics, science, chemical and energy development, engineering and technology that it has become a veritable and indispensable tool in national development.

Nature and Challenges of Mathematics in the 21st Century

In view of the fast growing technological and engineering society, one may ask what the challenges of mathematics in Nigeria are and what should be the nature of mathematical instructions that are capable of propelling a veritable and good society. To learn the essential mathematics needed for the 21st century, students need a non-threatening environment in which they are encouraged to ask questions. The learning conditions should incorporate high expectations for all students regardless of sex, race, handicapping condition or socio-economic status. Students need to explore mathematics using manipulative, measuring devices, models, calculators and computers. They need to have opportunities to teach each other about mathematics. Students need models of instruction that are suitable for the increased emphasis on problem solving, applications and higher skills. For instance, cooperative learning allows students to work together in problem-solving situations to pose questions, analyse situations, try alternative strategies and check for reasonable results.

In this situation therefore, the following propositions regarding the nature of mathematics instruction to boost the status of mathematics becomes relevant:^[11] Some of these challenges are similar with those put forward by the ^[12], particularly as it affects the nature of

mathematical instruction for the 21st Century in Nigeria. ^[13] captured these challenges as follows:

The Challenge of Teachers

^[14] opined that the low quality of the teaching personnel constitutes a serious problem in the quest for social reconstruction. Students cannot acquire the necessary skills that are needed in transforming Nigeria in terms of technology without sound and educated teachers. Going by the common saying that “you don’t give what you don’t have”; unqualified teachers lack ability to deliver the contents to those they are teaching beyond what they have already known. If the teacher knows little more than the learners, he may not be able to give concrete interpretation to a concept of which greater understanding can be derived. A teacher who possesses a limited understanding of the subject matter cannot deliver effective teaching as he leaves the gap between the contents and its application which invariably will affect student’s knowledge of applicability. Another challenge posed by the teachers is the fact that Mathematics teachers in Nigeria are grossly inadequate.

The Challenge of Students

A vast majority of Nigerian students fear and dread mathematics. This is because of the seemingly abstractness of its concepts. ^[15] observed that many students do not immediately see the use or applicability of the subject to their lives and to the world of work around them; so they wonder why they should be troubled with the study of the subject. To these young minds, mathematics still remains a mystery that has no place in reality. Students in secondary schools view mathematics as requirement in gaining admission into higher institutions of learning. ^[15] averred that it is particularly disappointing to find that mathematics

has remained one of the least successful subjects in Nigerian schools despite its importance, and time it receives in an average school system.

The Challenge of Curriculum

Curriculum is an important instrument in educational system. As education is central to the society, so is curriculum which is the heart and life-wire of education ^[16]. Curriculum is the propeller of educational programmes and practice. The non functional or non implementation of it is injurious to any educational system.

Moreso, the mathematics curriculum right from the time of introduction of modern mathematics in Nigeria has remained the subject of controversy for teachers and all other practitioners of mathematics. They perceived the curriculum as foreign in nature having little or no ability in addressing the adequate needs of Nigerians and the Nigeria system. With this raging war in curriculum contents, there is no doubt that ineffective delivery of mathematics concepts to students will be a standing order in the system. The perceived external curriculum contents coupled with the nature of mathematics and its concepts makes mathematics more dreadful and scarring in the mind of the learners.

The Challenge of Society

It is common to have Nigerian adults declare their lack of competence in mathematics publicly without any feeling of shame whatsoever. This kind of demoralizing and derogatory statement and attitude towards mathematics displayed by the adult members of the society embolden students to continue in a downward trend in their hatred for the subject and lack of mathematical knowledge; this has been made

evident with their show of poor performance in the subject during national examinations.

The Challenge of Funding

The issue of funding by the government and other relevant authorities has been a major challenge to mathematics education. The budgetary allocation to the education sector has been grossly inadequate as compared to funding from both developed and some developing countries. In Nigeria, education sector has not received topmost priority in budgetary allocation as it deserves over the years.

RECOMMENDATIONS

Based on the findings and opinions of the authors consulted, the following recommendations are therefore made:

- a) Students should experience mathematics as active, engaging and dynamic;
- b) Highly qualified and competent mathematics teachers should be employed and current euphemism of “man knows man” should be discouraged as regard recruitment and appointment.
- c) Teacher training institutions should put up programmes and incentives to encourage many students to read and study mathematics.
- d) Regular capacity building workshops and professional development programmes for mathematics teachers should be organized.
- e) Students should learn to view mathematics as a human discipline to which people of many background have contributed;

- f) Mathematics instructions should at all time make appropriate use of modern technology tools such as calculators and computers;
- g) Classroom activities should be organized to build on students' intelligent quotient to remember more ideas and information acquired through experience;
- h) Mathematics instruction should make extensive use of writing assignments, open-ended projects and cooperative learning groups;
- i) Mathematics instruction should acquaint students with the history of mathematics and its numerous connections to other disciplines;
- j) Applications that motivate theory enable students to recognize that theory contribute to their understanding;
- k) Teachers should use a variety of teaching strategies and students should be given opportunities to participate in mathematical discourse to build their confidence about knowing and using mathematics. This can be achieved through active participation in student mathematical clubs and societies;
- l) Students should be encouraged to pursue independent explorations in mathematics.

CONCLUSION

Mathematics is an indispensable tool in all human endeavours in any nation especially a developing country like Nigeria that is aspiring to be a great world power. The central position that mathematics occupies in science and technology and in agriculture as highlighted in this review, indicates that mathematics is the bedrock of science and technology. This paper reviewed the place of mathematics in Nigerian

science and technology system. It looked at the nature of mathematics in the 21st century in Nigeria and submitted that in post harvest management, mathematics has a great role to play. Efforts must be made by stake-holders to put mathematics on a sound footing in Nigeria in order to propel the nation for a dynamic science and technology in the 21st century.

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