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Mathematics Education for Dynamic Economy in Nigeria in the 21st Century

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ABSTRACT The Nigeria economy requires Mathematics that can effectively put science and technology in the forfront 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 a dynamic economy. The challenges of Mathematics education in the 21st century were highlighted to include: i. Incorporating new developments in Science and Technology into Mathematics, ii. Acceleration of programs for the continued professional development of teachers; and iii. Need for Mathematics educators to find new assessment instruments that reflect the new expectation of mathematics education.

INTRODUCTION

Mathematics Education in Nigeria has come a long way. In the traditional society, before the introduction of formal education, mathematics was used mainly in taking stock of daily farming and trading activities. Most traditional societies has their number systems which were either base five or twenty. These could be seen in their market days and counting systems. However, the coming of the missionaries introduced formal (or Western type) education to Nigeria. In this system of education, mathematics occupied a central position in the school curriculum. This has remained the position in the Nigerian education system today, even with the introduction of the 6-3-3-4 system of education. In this system, mathematics is a core subject from the primary through the junior secondary to the senior secondary school levels of the educational system. This important position occupied by the subject in the school curricula is borne out of the role of mathematics in scientific and technological development, a sine-quanor in national building. As Baiyelo (1987) observes, mathematics is widely regarded as the language of science and technology. This observation was also made by Abiodun (1997) when he stated that while science is the bedrock that provides the spring board for the growth of technology, mathematics in the gate and key to the sciences. Ukeje (1997) in acknowledging the importance and contribution of mathematics to the modern culture of science and technology stated 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". Mathematics, education is therefore indispensable in nation building.

Since the introduction of formal education in Nigeria, mathematics education has gone through several developments. From the era of formal Arithmetic, Algebra, Geometry and the likes through the period of traditional mathematics and the modern mathematics controversy to the present everyday general mathematics. These changes have always been necessitated by the realization of the role mathematics should play in the nation's scientific and technological development as well as responses to societal needs and demands (Aguele, 2004). The World today is aptly regarded as a global village, characterized by computer and information technology. This age has brought with it lots of sophistication in mathematics to be able to sustain these developments. Against this background this paper therefore reviewed the role of mathematics in nation building and attempted to look at the vision and nature of mathematical instruction, and the challenges of mathematics in the 21st century in Nigeria.

ROLE OF MATHEMATICS IN NATION BUILDING

Today, it is a reality that it is the creation, mastery and utilization of modern science and technology that basically distinguishes the so-called developing from the developed nations of the world. That is to say that the standard of

living of a nation is dependent on the level, of science and technology of that nation. While science is the bedrock that provides the springboard for the growth of technology, mathematics in the gate and key to the sciences. In other words, it is the level of mathematics that determines the level of the science and technological component of any nation. The foundation of science and technology, which is the basic requirement for development of nation, is mathematics. Therefore, mathematics plays a vital role in nation building.

Mathematics as observed by Abiodun (1997) is the major tool available for formulating theories in the sciences as well as in other fields. It is used in explaining observation and experiments in other fields of inquiry. Adeyegbe (1987) 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 is a science of the methods by which quantities sought are deducible from others known or supposed. Thus, anyone who neglects mathematics may not be able to go far in the sciences and in fact other things of the world.

Practical work and observation of nature are the main source of scientific discoveries. Mathematical methods play a very important role in this. Mathematical methods lie in the foundation of physics, mechanics, engineering, economics, chemistry and so on. According to Bermant in Harbor-Peters (2000), an important feature of the application of mathematics to sciences is, that it enables us to make scientific predictions that are to draw on the basis of logic and with the aid of mathematical methods, correct conclusions whose agreement with reality is then confirmed by experience, experiment and practice. Thus mathematics is the bedrock of science and technology, which is the springboard of national development.

Mathematics today is having an enormous impact on science and society. The influence may be silent and appear hidden but has shaped our 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 mathematics. Mathematical sciences have helped improve the ability to predict weather, to 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 are 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. Ukeje (1997) observes that improved scientific knowledge and the availability of modern technology, even if indigenous, will certainly increase economic productivity and viability. However, the state of science and technology is a function of the development and application of mathematics. Reference could be made of the ever-growing mathematical concepts and systems that are being applied effectively for the service of man. Examples of this abound in areas such as the application of system analysis to achieve cost effectiveness in various industrial and management systems, utilization of fuzzy logic and fuzzy control for equipment manufacturing and econometric in the solution of economic problems.

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 scientifically engineered society of today, one may want to ask what should be the challenges to mathematics education in Nigeria. In addition, what should be the nature of mathematical instruction that is capable of propelling a veritable and dynamic 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 and take risks. The learning climate should incorporate high expectations for all students, regardless of sex, race, handicapping condition, or socioeconomic status. Students

need to explore mathematics using manipulative, measuring devices, models calculators and computers. They need to have opportunities to talk to each other about Mathematics. Students need modes of instruction that are suitable for the increased emphasis on problem solving, applications and higher order thinking skills. For example, cooperative learning allows students to work together in problem-solving situations to pose questions, analyse situations, try alternative strategies and check for reasonableness of results.

In this circumstance therefore the following propositions regarding the nature of mathematics instruction to boost the status of mathematics becomes relevant. These include:

(a) Students should experience mathematics as active, engaging and dynamic.
(b) Students should, learn to view mathematics as a human discipline to which people of many background have contributed.
(c) Classroom activities should be organized to build on students' previous experience. Students tend to remember more ideas and information acquired through experience.
(d) Mathematics instruction should at all times make appropriate use of technology, especially calculators and computers.
(e) Applications that motivate theory enable students to recognize that theory contributes to their understanding mathematics.
(f) Mathematics instruction should make extensive use of writing assignments, open-ended projects, and cooperative learning groups.
(g) Mathematics instruction should acquaint students with the history of mathematics and its numerous connections to other disciplines.
(h) Teachers should use a variety of teaching strategies and should employ a broad range of examples.
(i) Students should be given the opportunity to participate in mathematical discourse to build their confidence about knowing and using mathematics. This can be achieved through active participation in students' mathematical clubs and societies.
(j) Students should be encouraged to pursue independent explorations in mathematics.

Some of these propositions are synonymous with those put forward by the National Council of Teachers of Mathematics (NCTM, 1995).

Arising from the above, particularly as it affects the nature of mathematical instruction for the 21st century in Nigeria, there are some challenges. Some of these challenges include:

1. There is no gainsaying that the full impact of technology on the teaching and learning of mathematics and on issues of equity is only beginning to be explored. These need to be consolidated.
2. In order to thoroughly incorporate new developments in mathematics into classroom instruction, serious re-examination of the entire mathematics curriculum will be required. This is usually not an easy process.
3. The changing processes in mathematics education make it critically important to accelerate programs for the continued professional development of teachers. That is, in order to implement the new vision of mathematics education, colleges and universities will need to reflect the same principles in their programs for the preparation of teachers.
4. As calls for accountability of educational institutions echo in society, mathematics educators and mathematicians need to find new assessment instruments that reflect the new expectation of mathematics education.

It may be emphasized further that these challenges call for multiple yet consistent responses from teachers, administrators, parents, government policy makers and others concerned with education in Nigeria. This is an effort to put mathematics education on a sound footing to facilitate the realization of a great and dynamic economy in Nigeria.

CONCLUSION

This paper reviewed the place of mathematics in the Nigerian educational system. It looked at the nature of mathematics for 21st century economy in Nigeria and submitted that mathematics has a great role to play in nation building. 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 economy in the 21st century.

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