

MATHEMATICS IN THE TECHNOLOGICAL DEVELOPMENT IN THE 21ST CENTURY- IMPLICATIONS FOR SECONDARY EDUCATION

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Abstract

Mathematics is the language of the sciences. Science is the basis of technology and technology is the foundation for modern development. Mathematics is the only sure way of achieving technological development in the 21st century. The paper examines the relationship among mathematics, science and technology; present state of the teaching and learning of mathematics in our secondary schools; and makes recommendation for the improvement of the situation,

Introduction

According to Dewith (1969), education in general, science and mathematics education in particular must be conceived as a process of social assimilation, as well as the means for the transmission of scientific and technical knowledge needed to transform rural societies of Africa into modern urban, industrial states.

Mathematics is described as the queen or the servant of the sciences, mathematics, according to Aminu (1995), is not only the language of the sciences, it is the essential nutrient for thought, logic, reasoning and therefore, progress. Science is the foundation of technology and technology is the bedrock of modern development. Therefore, mathematics is the foundation of science, technology and modern development. For any nation to survive and develop, it has to improve its technology which can only be achieved through effective teaching and learning of mathematics in our schools.

It is in realisation of this that many countries now resort to make special, comprehensive and well programmed efforts toward the effective teaching and learning of science and mathematics at all the levels of our educational system through the development and implementation of innovative programmes and projects. Thus, if Nigeria is to attain high development in the 21st century, some well-packaged programmes have to be put in place.

Unfortunately, the teaching and learning of mathematics at all the levels of the educational ladder is in a dismal state. So we are to focus our attention on the way out of this dismal and unfortunate situation.

Science and Technology

According to Dewith (1969), "Science without the by-play of technology becomes sterile while technology without science becomes moribund".

We may now attempt a formal definition of science and technology though they have a clear symbiotic relationship.

Simply put "science is an organized knowledge of our material environment and such knowledge derives from the systematic study of the structure and properties of matter". For Ikoku (1989), technology is simply the rational utilization of energy in any process designed to satisfy need. Such rational deployment of energy has the net result as the re-organization of matter in new form that enables its more facile utilization by man for a better life.

Science according to the Oxford Advances Learner's Dictionary is "knowledge arranged in an orderly manner especially, knowledge obtained by observation and testing of facts, pursuit of such knowledge".

For Daniyan (1998), technology, simply is the practical application of scientific or other knowledge and a major source of economic expansion.

Technology is thought of as "know how" while science is usually regarded as "know why". Thus science is essentially a methodology which is employed to produce and accumulate knowledge while technology produces services and goods, or employing socio-economic language, technology produces wealth. In advanced countries today science and technology have advanced at an exponential rate and man has gained considerable control over nature. But in less developed countries like Nigeria there is the problem of stultified growth even in the areas of science and technology and there is the need for an amelioration of that state of affairs so as to enable the recruitment of science and technology for

S.C. Mohammed

the task of national development with corresponding rise in standard of living.

Science and technology education is defined as organized instruction, both formal and informal, designed to produce a corps of people who can utilize the ever growing body of scientific and technological knowledge in productive endeavours, teaching and skills transfer. Some of that trained corps of people would also be committed to the advancement of scientific and technological knowledge through fundamental or targeted research (Ikoku, 1989).

Nations try to improve their science and technological education for the purpose of the development of their countries. The desire of a nation is to achieve social, economic, political and technological development. Development has been defined as: the collective activities by any human society directed at reducing the totality of perceived obstacles to a higher standard of living thus maximizing the quality of life for its citizens (Ikoku, 1989). The advanced countries have achieved high level of development because of their high technological advancement. Nigeria's under development could readily be traced to her lack of economic development which in turn stems from her contemporary backwardness in science and technology. Therefore, there is the urgent need for the technological development of our country in order for us to join the advanced world. This can only be achieved through the improvement of mathematics in our schools.

For Ikoku (1989), technological development connotes the ability of the nation to locate its natural resources to transform such raw materials into more useful products in the most efficient manner to substitute for scarce (usually imported) with local and more abundant ones and generally to endeavour to make the most economical the productive use of what the country has.

These desirable goals which define technological development are attainable only when the country has a sizeable body of men and women trained in the relevant science and technology. Technological development is only meaningful if it is seen to identify completely with the citizens of a country - their total circumstances on earth their values, set social aspirations, priorities and the material resources at their disposal.

Therefore the people of a country need to be trained mathematically in order to achieve technological development in line with their culture and natural endowments.

Secondary School Mathematics for Technological Development in the 21st Century

Technology is the product of human resourcefulness. In technological development, therefore, people are at the centre-they must be mobilised and programmed.

We have noted that mathematics is the foundation, of science and technology. So for any meaningful technological development in the 21st Century, the teaching and learning of mathematics at all levels of the educational ladder have to put in its proper footing.

Mathematics at the Secondary School level determines the courses students offer at the tertiary institutions. Students' performances and knowledge of mathematics at the Secondary determine whether or not the student would continue with mathematics and other sciences in tertiary institutions. Therefore, mathematics at this level is very crucial and has immense effects on a nation's technological development. As at now the teaching and learning of mathematics in our Secondary Schools leave much to be desired. This is evidenced by the poor performances of students in school both internal and external examinations. This unfortunate and dismal situation of mathematics at this level has been attributed to poor curriculum, poor teaching, lack of qualified teachers, lack of teaching facilities and textbooks, high work load of teachers and poor image of mathematics in our society amongst other factors. Since education is the vehicle for technological acquisition, education should lead to development; principally by stimulating resourcefulness. Thus the mathematics we teach must be able to stimulate human resourcefulness. To achieve technological development in the 21st century, I recommend the following lines of action for our Secondary Schools.

Good Subject Combination with Mathematics

Many students are not properly guided in their selection of subjects with mathematics. Many students tend to end up with unsatisfactory subject combinations at the school certificate level, thus confounding any chances of entry into degree courses in mathematics and science without some kind of remedial course interposed. For example, Physics has for a long time been a notorious killer of ambitions of students in the sciences.

Mathematics in the Technological Development in the 21st Century-Implications for Secondary Education

Many students offer mathematics at the tertiary level without good background in other sciences especially Physics. Mathematics cannot be effectively studied without the other sciences. Students should be properly guided on their subject combinations at the Secondary School level. A good subject combination of mathematics with other sciences would improve the situation of having more scientists for our technological growth.

Recruitment of More Mathematics Teachers for the Secondary Schools

Teachers form the “hub” of the educational system. There is acute shortage of the mathematics teachers in our secondary schools. There should be massive injection of mathematics teachers into the schools, if possible through expatriate recruitment. Besides the problems of the teaching profession needs to be sincerely addressed. The profession needs to be made more attractive by creating some incentives. That students do not want to study mathematics in our higher institutions needs no further documentation. This is because they do not want to come out as teachers of mathematics that would make them like second class citizens.

When teachers are attracted to the profession and retained the teaching and learning of mathematics would be improved upon. There should be incentives to attract students to mathematics teaching and retain them on the job.

Curriculum Review

The existing curriculum of mathematics should be reviewed to enable mathematics students acquire more knowledge of the applications of mathematics relevant to our societal needs. The theoretical nature of syllabus contributes to mystifying mathematics, as the theories are not often related to practice. Mathematics is applied to almost all spheres of human endeavor. Secondary School students should be exposed to these areas. “It is the element of practical action that clearly demonstrates the quality of self reliance in a curriculum” (Azuka, 1997). The effective combination of mathematics with its applications would:

- a. Make mathematics more relevant to the needs of the society and more acceptable to the society.
- b. Attract more students to study mathematics in tertiary institutions instead of rushing to other courses.
- c. Enhance the technological growth of our nation.

Upgrading of Mathematics and Mathematicians

The teaching and learning of mathematics needs to be popularized in every nook and cranny of the country. The public and the industrial sector should be enlightened on what mathematics and mathematicians can do in calculations and modeling. Public awareness and recognition about mathematics and mathematicians would bring about more acceptability of mathematics and mathematicians by students and the general public. The nation needs to upgrade the subject and its practitioners, conferring on them the desired recognition. These would enable mathematics and mathematicians contribute more to the technological development of our nation. These would arouse and sustain the interest of students in the study of the subject.

Retraining of Mathematics Teachers on the Pedagogy of Teaching

One of the factors which cause poor performances of students in mathematics in secondary schools and discourage students from studying mathematics is poor teaching. Sober (1988) puts it.

- Teachers must know the stuff.
- Teachers must know the pupils whom they are stuffing.
- And above all, they must know to stuff them artistically.

Thus mathematics teachers must be properly trained and retrained to be able to bring up the secondary students in mathematics for our technological development.

The National Mathematical Centre, Abuja, has initiated actions towards the retraining of mathematics teachers at the primary and secondary school levels using mathematics teaching modules. This is an innovative teaching material which would improve the teaching standards of our teachers. The National Mathematics Centre had already started with the Polytechnic Lecturers in letting mathematics and physics lecturers. This will also be extended to Colleges of Education

S.C. Mohammed

lecturers as well.

When our teachers are properly retrained on the methods of teaching and the applications of mathematics in technology, these would lead to:

- a) Better performance of students.
- b) Arouse and sustain the interests of students and teachers in the study of the subject.
- c) Show the connections between mathematics and technology.

Establishment of Mathematical Sciences Laboratory

A laboratory for the mathematical science should be established in each secondary school. This should be equipped with mathematics teaching aids and models and other sciences teaching aids and models. This should give opportunities for mathematics teachers and students to demonstrate the relationship between mathematics and other sciences. Students would be exposed to the application of mathematics to other sciences and technology. There should be simple toys which are based upon our familiar surroundings, but which display simple principles of science, like the lever. Mathematics students should be exposed to the application of mathematics to science and technology. This would not only motivate the student but would increase the acceptability of mathematics by students. These would help the students to think about physical phenomenon in mathematical terms which would form the basis of their technological thought

Greater Investment in Mathematics and Mathematics Education

There is need for greater investment in mathematics and indeed mathematics education. By this we may be able to induce the young ones to study mathematics and at the same time retain the present crop of mathematicians in our secondary schools. The National Mathematical Centre should be properly funded to develop and implement the strategies and devices for the improvement of the teaching and learning of mathematics in our educational system. By so doing, we would be strengthening our technological base for the much needed economic development so that we can move out of the enclave of under-development.

Conclusion

Mathematics is the very basis of all sciences and technology, and therefore, all human progress. Therefore, if we must develop technologically and economically we must put functional and technology policies in place. We must place mathematics in its proper perspective. If these are not done, Nigeria would continue to grope in its darkness of under development in economic and technological spheres.

We have to redirect our priorities and resources towards the implementation of suggestions made in this paper. The teaching of mathematics should be practicalised and linked with other sciences. The public and industrial sectors should be enlightened to appreciate mathematics and mathematicians. Mathematics is inseparable from science and technology, and indeed, it is the hub of the science and technology. Since secondary school mathematics forms the gateway to the study of mathematics in our tertiary institutions, we must develop it now.

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