

REFLECTIONS ON TEACHING / LEARNING OF SCIENCE, TECHNOLOGY AND MATHEMATICS FOR QUALITY EDUCATION IN NIGERIA IN THE 21ST CENTURY

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Abstract

Mathematics has been one of the subjects for which students in primary and secondary schools develop hatred and thus, they perform poorly in it. The actualization of quality education in Nigeria cannot therefore be achieved without a qualitative and functional mathematics education. Mathematics is a veritable instrument for without mathematics, there is no science and without science, there is no technology and without technology, there is no modern society. This paper therefore looks at the impact of mathematics on the society and the related problems facing the delivery; keeping abreast of the factors that influence teachers as they want to change their roles. Accordingly, mathematics educators should examine their ethical responsibilities in relation to the challenges facing humankind and we therefore recommend that mathematics teachers must think over their current practices or methods and be very practical in teaching. Based on the above facts, the paper tries to look at the impact of mathematics on the society and the factors that influence teachers in performing their duties as related to the demand of the century.

Students' poor performance in sciences, most especially in mathematics, is no longer news in this country. Examining bodies, West African Examinations Council (WAEC), National Examination Council (NECO) and National Board for Technical Education (NBTE), complain about the mass failure and poor performance in the subject every year.

Mathematics today is having an enormous impact on science and society. The influence may appear hidden but has shaped the entire world. Aguele and Usman (2007) believed that 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. Adeyegbe (1987), Abiodun (1997) and Harbor-Peters (2000) all reiterated the importance of mathematics to science. They are of the opinion that mathematics enables us to make scientific predictions based on logic, and with the aid of mathematical models, correct conclusions are drawn based on experience, experiment and practice. Thus, mathematics is the bedrock of science and technology.

Fafunwa (1974) had this to say about science, mathematics and technology: "we are living in a world where Science and Technology have become an integral part of the world's culture, and any country that overlooks this significance does so at its own peril".

No other subject has greater application than mathematics; it is the prime instrument for understanding and for exploring our scientific, economic and social world. Today, all fields of knowledge are dependent on mathematics for solving problems and predicting outcomes. Ilori (2003) writing on mathematics as a service subject was of the opinion that the choice of science subjects at a certain level is very much related to ability in mathematics, because

proficiency in mathematics is of basic importance to the study of other sciences.

Strengthening Mathematics and Science Education (SMASE-Nigeria) baseline survey (2006) revealed that science school teachers are aware of appropriate methods for teaching mathematics and science effectively but their classroom practices are teacher-centered and content based with little or no activities. The teachers often used lecture and demonstration methods and at times group method which resulted in low pupil participation and then compromising the quality of learning and mastery of content. This unfortunate situation is further compounded by the gross lack of understanding of many basic science and mathematics concepts as exhibited by the students.

Based on the above facts, the paper tries to look at the impact of mathematics on the society and the factors that influence teachers in performing their duties as related to the demand of the century.

Impacts of Mathematics on the Society

Olanipekun (2003) stated that as man became confronted with his environment and to make his living in it suitable for him, he started to use his brain and hands to invent things. Though the positive impacts of mathematics nowadays may be hidden, it is still an indispensable tool in creating new things or knowledge. Some of these roles may be found in the following field.

(1) Agriculture:

- Development of chemicals to improve agricultural products and general elimination of pests and diseases.
- Irrigation technology makes it possible to produce crops all the year round.

- Development of machines for mechanized farming.

(2) Engineering:

- Development of aircraft, cars and ships to ease human transportation.
- Development of computers and its accessories to analyze results.
- Development in ICT (Information, Communication and Technology) in areas of G. S. M, E-mail, Electronic mail, Fax, Face book, Satellite etc. to make the world to become a global village in one's pocket.
- Development of television, radio and others.

(3) Medicine:

- Development of drugs.
- Surgical operation and text tube babies are made possible through mathematics.
- Development of X-ray, scanning machines, microscope and others for treatment.

(4) Energy:

- Power generating plant.
- Mineral discovery through Science, Technology and Mathematics.
- Development of applied solar technology has helped man greatly.

(5) Military:

- Development of modern equipment / war machines for territorial defense.

Constraints on the Teaching / Learning of Sciences, Technology and Mathematics Education

The major problems facing teaching and learning of science, technology and mathematics in Africa, most especially in Nigeria, include:

1. **Lack of basic facilities:** Today, most schools in the country seriously lack good infrastructural facilities, relevant textbooks and other teaching / learning

materials. In fact, most of the books in the schools are now obsolete. The structures under which the students are learning are nothing to write home about. In addition to this, the equipment deteriorates for lack of reagents and spare parts.

2. **Attitudinal Problem:** According to Federal Ministry of Education (FME) (2006), attitude is the external expression of our internal beliefs and conviction. It determines the decision we make in life and ultimately the actions we take. It is not therefore surprising to notice that some aspects of the Nigerian culture have great influence on the way science, technology and mathematics education are conceived. Tsuma (1998), believed that culture affects the teaching / learning of sciences and mathematics. For example, the belief that practical work is dispensable to science and mathematics education is a serious threat to the development of science and efforts to inculcate a techno-scientific culture in Africa. Also, Jegede and Okebukola (1992) observed that the concept of the sacredness of science is related to the conceptual interpretation of science. Some even hold the belief that science and mathematics are only possible for someone from non-western society only if such a person is above average in intelligence.
3. **Examination Problem:** Tsuma (1998) was of the opinion that, all over the world the examination system has a great deal of influence on what teachers teach and what students learn. Teachers worry about accountability and fear that they may be judged as incompetent if their students do not perform to public

expectation in an examination. On their part, students are only conscious of the role of examinations in determining their future destinies. Good examination results mean good certificates, which increase prospects. As a result of this, teachers who focus on examinable content and neglect the non-examinable content easily fall by the way side. Apart from the afore-mentioned problems, the SMASE-Nigeria conducted a baseline survey in 2006 and they identified the following similar problems as affecting the teaching / learning of science and mathematics.

- Poor teacher / pupil interaction during teaching.
- Poor or lack of mastery of subject matter.
- Use of inappropriate methodologies by the teachers.
- Negative attitudes by teachers and learners towards science and mathematics.
- Perceived difficult topics, by the learners and teachers.
- Large number of learners per classroom.

Factors that Influence Teachers as They Try to Change their Role and Actions in Teaching / Learning of Science and Mathematics

The following factors were observed as seriously affecting the teaching / learning of science and mathematics in Nigeria and the teachers are incapacitated to improve the situation:

- Access to internal support personnel in the teacher's development.
- Access to an extended and varied in-service program.

- The day-to-day conditions under which the teachers work among others.

In this 21st century, therefore, for Nigeria to boast of quality of teaching / learning of science and mathematics education, the following become paramount, according to National Council for Teachers of Mathematics (NCTM 1995).

- The learning climate should incorporate high expectations for all students, regardless of sex, race, condition or status.
- Mathematics instructors should, at all times, make appropriate use of technology e.g. calculators and computers.
- Science and mathematics instruction should connect students with the history of mathematics and its numerous connections to other disciplines.
- Students should be given the opportunity to participate in mathematical discourse to build their confidence about knowing and using mathematics. This can only be achieved through active participation in students' mathematical clubs and societies.
- Students should be encouraged to pursue independent explorations in mathematics.
- Applications that motivate theory enable students to recognize that theory contributes to their understanding of mathematics.
- Lastly, students should learn to view mathematics as a human creation to which people of different background have contributed.

Challenges of the 21st Century

According to Aguele and Usman (2007), there are the following challenges:

1. In order to thoroughly incorporate new developments in mathematics into classroom instructors, serious re-examination of the entire science and mathematics curriculum will be required.
2. For the changing process in mathematics education to be effective, colleges and universities will need to reflect the same principles in their programs for the preparation of teachers.
3. As calls for accountability of education institutions to the society, mathematics educators and mathematics need to find new assessment instruments that reflect the new expectation of mathematics education.

Recommendations

Arising from the above, particularly as it affects the teaching / learning of science, technology and mathematics education for quality education in the 21st century, this paper recommends the following points:

1. Mathematics teachers must rethink on their current practices and then be encouraged to develop, in very practical terms, a clear vision of what the suggested changes in science, technology and mathematics education imply for their own personal behavior and roles as a mathematics teacher.
2. Mathematics teachers need access to exemplary curriculum materials that will help them reflect on their current roles as teachers, try out new roles, and modify their actions as teachers in line with the accumulated experience of the many teachers involved in the development and testing of the materials.
3. Also, science, technology and mathematics teachers need access to a

motivating and well-structured in-service program that focuses on supporting their professional growth as they try to reshape how students learn science and mathematics in their classrooms.

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