The Relevance of Mathematics Education in the Nigerian Contemporary Society: Implications to Secondary Education

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

Mini-review Article

ABSTRACT

This paper highlights the universal importance and application of Mathematics to man and his environment. Several other intervening factors were suspected to be responsible for the poor performance of secondary school students. Suggestions were made for further in-depth research into the effect of such factors. It is hoped that this submission would help student's have an ardent interest in mathematics, so much so that more and more students would begin to choose mathematics as a discipline to study. If it does, the purpose of this discussion would have been achieved.

1. INTRODUCTION

Mathematics holds a rather unique place in our society today. That was why Keyser [1] stated that, Mathematics, even in its present abstract state, is not detached from life. It is just the ideal way of handling the problems of life. There is no disagreement today nor would there be any in the foreseeable future of the vital importance of mathematics both to the scientists, engineers or other specialists and the intelligent layman in his everyday life. Makarfi [2] further noted that, in all

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human endeavours, there exists mathematics. Every individual both consciously or unconsciously needs and uses the knowledge of mathematics to certain extents at anytime, anywhere and in every place.

The uses of mathematics to man therefore are as diverse as there exists fields of human endeavour. Agah [3] however lamented that almost no one today in Nigeria is concerned with the teaching of mathematics at any stage, from infant upwards and particularly at secondary level can honestly say to himself that all is well with the teaching of mathematics. Hence, today there are many students who leave the secondary school with a dislike for mathematics. One reason we can advance is that a majority of students never get true understanding of real meaning of mathematics concepts. Eventually, they develop a common attitude; get the examination over with, after which they forget mathematics. This is the position in our country now. If we are to build successful programmes of mathematics in our secondary schools and if we are to provide for the continuous improvement of the learning of mathematics, it will seem that such a consideration must begin with an understanding of the very nature, the very heart of mathematics itself.

2. WHAT IS MATHEMATICS?

Yara and Otieno [4] define mathematics as Creation of the human mind concerned primarily with ideas, processes and reasoning. Ugwu, [5] stated that Mathematics is the study of all structures, whose form can be expressed in symbols, it is the grammar of all symbolic system. Russell, the eminent English Mathematics philosopher has presented a contrary view of Mathematics, as reported by Fremont [6] that ". . . May be defined as the subject in which we never know what we are talking about, nor whether what we are saying is true." This is rather a striking view of Mathematics.

In summary of the different notions about mathematics, mathematics could be viewed as a way of thinking, a way of organizing a logical proof. It is a language that uses carefully defined terms and concise symbolic representations, which add precision to communication. It is primarily concerned with finding answers to questions and problems. It is an art. In the light of these, if teachers of mathematics are to open the eyes of their students to the wonders and beauty

of mathematics, it is imperative that these same teachers be themselves aware of the varying considerations regarding the stuff of which mathematics is made. They must be convinced about the usefulness of the subject that they may be able to convince the students to feel likewise.

Our secondary school students must be able to understand and apply mathematical ideas, but this depends on whether or not a student believes mathematics will be of personal value. The differential perception of the usefulness of mathematics by different students presents some problems in our secondary system today. Some of these students often point to a single teacher as the cause of either their liking mathematics or disliking and avoiding mathematics. Again it is not uncommon to find that many students go through the school system believing that mathematics is difficult simply because their peers told them so. Extremely interested in their peer's opinion and this will often tailor their behaviour to harmonize with their peers expectations.

As mathematics teachers, we are also responsible for the general education of our students. We must build attitudes, patterns of investigation and problem solving skills that are broader in usefulness than knowledge in its own sake. We should be concerned about the insight into other fields of knowledge that mathematics can give our students. We should help students become informed about the nature of mathematics and encourage them to recognize mathematics as important among others.

3. THE PREVAILING STATE OF TEACHING MATHEMATICS IN SECONDARY SCHOOLS

The teaching of mathematics in secondary school is far from adequate. There are various problems such as teachers and their method of teaching, students 'attitudes towards mathematics, materials for teaching mathematics, parents 'attitude towards mathematics, government policy, and WAEC examinations, [7].

Teachers live together with their students in the classroom over an extended period of time. The relationships that exist between students are also going to influence their performance at school. In the conventional classroom, the teacher plays a central role by attempting to provide the condition under which learning will occur most successfully

for the group of students in a particular class at a particular time. The teacher translates or interprets the intended curriculum for the students. Therefore, teachers have an important influence on the ways in which students learn mathematics, and on their performance in the subject. That was why Iji and Uka, [8] stated that "Teachers bring to the classroom their beliefs and attitudes towards mathematics and these have a bearing on those formed by students." This report shows that the teacher's attitude to his student, his mood, his method of teaching, his approach and behaviour towards his students and his subject have some reflections on the student performance. Students must perceive that the teacher is serious about teaching of mathematics before there can be progress. When a teacher's expectations are not clear, then the students will attempt to define the limits under which they may operate. So, among various teachers, the work of mathematics teachers is particularly satisfying. They have a very important body of knowledge and skills to convey, part of which is mandatory if people are to participate successfully in the life of our society.

Uka and Iji [9] regard the causes of failure in mathematics in West African Senior School Certificate Examination (WASSCE) that qualified teaching staff is lacking in schools. They went further to say that, even when the teachers are available, they don't stay in one school because of constant transfer and frustrations. We are aware of the fact that no two individuals are the same, their mode of teaching and relationship with students will definitely affect the students' performance. Therefore, teachers need to be more aware of their impact on students' performance with respect to their teaching of the subject.

Attitude is the tendency to react favorably or unfavorably towards a designated class of stimuli. Mohamed and Waheed, [10], define attitude as mental and neural state of readiness organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situation with which it is related. Therefore, attitude is a persistent disposition to act either positively or negatively towards a person, object, situation or values and the readiness to respond in a predetermined manner towards a person, object situation or values and the readiness to respond in a re-determined manner to those objects. Asante, [11] mentioned that, "poor performance

of students was as a result of their poor attitude and lack of interest in the subject." He further stated that, "no matter what efforts the teacher might put forth, it is most unlikely to yield any fruitful results." It means that many students are of the view that mathematics is difficult, and as such, the effort of the teacher will not make such students perform well in the subject.

There are others who have taken their time to see how students' attitudes influence their performance. Odili [12] says that, "Attitude and feelings about mathematics are important factors influencing students' performance in mathematics." Students, who have positive feelings about mathematics exert more effort, spend more time on tasks and are more effective learners than students with poor attitude. Mathematics teachers, therefore, must engage students in such a way that they are transformed from spectators to active participants.

In recent times teaching aids have received a lot of technological advancement that a new field known as "Educational technology" has been created from it. People learn by doing, as the popular saying goes, therefore learning takes place best when all senses are involved. First let us be clear about instructional materials. They are related to the term instructional development or design. Lloyd [13] defines it as "the systematic and continuous application of learning principle and educational technology to develop the most effective and efficient learning experience for students' activities that are relevant, evaluating the result of those activities and taking remedial action if necessary." From this view, it means that materials that perform or support the teacher to perform one or more of those functions are called instructional materials.

Some people refer to mathematics as the bread and butter of sciences. If the butter is omitted, the bread may not be palatable to chew. One way of buttering the bread is by the use of instructional materials. This is not new, as Cady et al. [14], pointed out that educators have advised since 1885 to employ manipulative materials in teaching specific concepts in mathematics. Mathematics laboratory therefore, stand as a resource centre for the learning of mathematics, may consist of a specially equipped room in the building where mathematics classes meet on a regular basis or a corner of the regular classroom with tables and equipment. Some psychologists have also studied the effects of the manipulative materials

on achievement, retention, attitude and transfer of mathematics concepts. Their results have led some, such as Piaget, et al. [15], to call for the laboratory approach. In a similar view, Kid, et al. [16] claim the following characteristics of mathematics instruction on a laboratory setting:

1. Relates learning to past experience and provide new experiences when needed.
2. Provide interesting problems for the students to investigate.
3. Provide a non threatening atmosphere conducive to learning.
4. Allow student to take responsibility for his own learning and to progress at his own rate.

Teaching and learning processes when instructional materials are effectively used, is believed to have become more interesting, more challenging, more effective and more rewarding.

Another source of students' poor performance could be traced from their parents' attitude to mathematics. Odili [17] says that, "lack of cultural advantages in the home may handicap students' performance in mathematics." He went further to emphasise that 'a home that has a television set, reference books, magazines and parents who take care of the children education provides great advantage for learning'. In many ways, attitudes and stereotypes that parents hold are passed on to their children. Therefore, students who receives parental support and encouragement to work hard in mathematics and who receives parental approval and praise for excelling in mathematics, is much more likely to persist in the subject than one who does not.

The policy makers of schools these days often complain of inadequate funds for staff`` development. The little funds available are often said to be mismanaged, Nwabueze [18] lamented that our secondary schools have become perhaps the most fertile ground for social unrest and indiscipline, resulting in their close down for long periods of time in each year, with a consequent disruption in academic programmes and a fall in the quality of education.

We see that, as a result of the above statement, students resort to rioting or demonstrating over one thing or another. Categories of staff, academic and non-academic are striking, which again invariably result in teaching and other essential services being paralysed. Regrettably, these circumstances seriously affect the performance of students in general and mathematics in particular.

For the benefit of all, government should provide sufficient fund for the development of secondary schools, pay staff salaries promptly, participate fully in staff welfare, organise workshops on mathematics because education periodically and should rehabilitate all schools for conducive learning environment.

4. SEX-DIFFERENTIATION IN MATHEMATICS ACHIEVEMENT

Differences in achievement which cannot be attributed to differential course-taking patterns have been reported to favour male students at the high cognitive levels. Linberg, Hyde; Peterson, & Linn, [19] stated that, the cultures in the centuries during which mathematics has developed have been male dominated and the creative work has been done largely by men." We observed that boys' toys and girls' toys are different in most families, there are different expectations in behavioural terms and it is assumed that different things will interest them. Certainly this sort of environment influence will create differences. This must be marked in subjects such as physical sciences and engineering, for there is much more encouragement for boys to learn how mechanical and electrical things work than there is for girls.

Salman, [20] reviewed some relevant literature relating to sex differences in mathematics achievement and found out that most research appeared to show no significant differences between boys and girls in mathematics achievement before they enter elementary school. However in his review relating to secondary school, where significant differences did appear, they were more to be in favour of boys when higher levels of cognitive tasks were being measured and in favour of girls when lower levels of cognitive tasks were being measured.

In summary, real mathematics education starts from the secondary school level. This is the level, during which the innate potentialities of the student's are to be explored, identified and properly channeled. Any student whose potentials for the study of mathematics are not identified, encouraged and developed at this stage would have been lost to the subject forever. Thus, any programme for the improvement of the teaching and learning mathematics must lay proper emphasis at this

level. Once the proper foundations are laid at this level, then an enduring super-structure could be expected. This is why the study of mathematics has been made compulsory at the secondary level.

5. THE RELEVANCE OF MATHEMATICS IN THE MODERN AGE

The increasing importance and contribution of mathematics to the modern culture of science and technology has been very well established. Indeed, Ukeje [21] outlined 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.

Jahun, [22] noted that In this period of Hi-technology and Internet superhighways, no nation can make any meaningful achievement, particularly in economic development, without technology whose function are science and mathematics. In fact, the achievement of any meaningful economic goals in this present age of Science and Technology must of necessity be largely dependent on the state of Science and technology that is ultimately on mathematics because the state of science and technology at any age is a function of the development and application of mathematics. One can trace the demand for solid Geometry, trigonometry and calculus to their application in sciences, engineering, drawing, surveying and mechanic. The algebra and analytic geometry were regarded as essential tools for calculus.

We are now in the midst of an overall revolutionary advance in the use of mathematics in the 21st century. The social studies, the schools of business administration, natural sciences are all increasing their demands of mathematics. The engineers and scientist are also broadening their interest in mathematics. The new users and uses of mathematics relate to its role as a language in terms of which theories and hypothesis can be precisely formulated and tested. For a long-time, mathematics was taught because of the training it was supposed to give to its learner. But now, there has grown a different attitude towards the subject mathematics. This is the attitude of UTILITY. Utility in a sense that, what mathematics is to other subjects.

Mathematics has played a very important role in building up modern civilization by perfecting all sciences (and arts). It is an efficient and necessary tool, which is employed by all the sciences. To this effect, it has been very properly said by Lassa [23], "mathematics is science of all sciences and art of all arts." For glimpses of its relationship with other subjects, here are some given examples from these subjects.

5.1 Mathematics and Physics

Perhaps no other subject is as close to mathematics as physics is for higher education in physics, it is helpful to know mathematics. Only a mathematical mind can take up the study of physics with confidence. Pick any standard book in physics, you will find that every rule and principle taken is from mathematics. Mathematics gives a final shape to the rule of physics. It presents them in a workable form.

5.2 Mathematics and Chemistry

Certain mathematical laws govern all chemical combinations and their equations. In manufacturing of any chemical, there are some mathematical ratios in which different elements have to be mixed. For estimation of elements in organic compounds, the use of percentage and ratio, etc has to be made.

5.3 Mathematics and Biology

Knowledge of mathematics is considered essential, for a biologist for some reasons. That is biological study depends largely on its branches, namely, Biomathematics, Biophysics and Biochemistry, which have attained a rank almost equal to that of independent subjects. It is therefore necessary for the biologist to study mathematics for the understanding of these branches.

5.4 Mathematics and Engineering

The use of mathematics in engineering is very well known. It is considered to be the foundation of engineering. That is why a good result in mathematics is necessary for admission to an engineering course. Engineering deals with surveying, leveling, designing, estimating, construction, etc. in all these processes, application of mathematics is very important.

5.5 Mathematics and Agriculture

Agriculture as a science has some relationships with mathematics. There are certain aspects of

Agriculture that needs direct application of mathematics such as measurement of area, average investment or expenditure, average return or income, production per unit area, cost of labour, time and work, seed rate, manure rate etc. to see progress in acceptable results, drawing of graphs of different items of production is essential.

5.6 Mathematics and Economics

Mathematics language and methods are used frequently in describing economics phenomena. Economics reasoning is largely dependent on mathematics principles. Statistical methods are applied in economics. That is different issues of economics can be represented statistically, such as trade cycles, volume of trade, trend of exports and imports, population trends, industrial trends, expenditure of public money etc.

5.7 Mathematics and Philosophy

A common man may ask how can there be any relationship between such widely different subjects. Usually, philosophy is defined as the science that investigates the reality of things. While, Mathematics is a creation of the human mind concerned primarily with ideas, processes and reasoning.

The main reason for studying mathematics in Europe in the 17th century was to acquire knowledge and put self in position to make inventions. That was why within that century, as reported by Smith [24] that "All Mathematicians were philosophers and all philosophers were mathematicians." Moreover, accumulation of ideas is not the aim of a philosopher. He wants to find the ultimate nature of things and for this he has to coordinate and synthesis different facts and bring all things into system. Thus, he has to proceed according to mathematical procedures. The twenty-first century is expected to experience more intensive increase in science and technology, and the foundation of scientific, technological and economic development is mathematics. It is therefore imperative that the dispensers of mathematical knowledge to the future implementers of this knowledge be properly trained so that they can be effective in their training of our citizenry.

6. CONCLUSION

To develop a society of men and women who are sufficiently knowledgeable to approach the affairs of daily life with a sense of objectivity and reason correctly, great emphasis must be placed on the teaching and learning of mathematics from primary school level of the nation's educational system. Teachers can guide this exploration and encourage an active learning of mathematics. This not only strengthens mathematics learning but also increase the student's performance in mathematics.

There is no doubt at all that all other disciplines are serviced and sometimes controlled by mathematics. Because developments in most other subjects are explainable in the language of mathematics, without which no reasonable communication can be made.

It is therefore not only necessary but imperative that the present generation of school children should have good knowledge of mathematics at least to that level of competence which will make them cope with the mathematical requirement of other disciplines.

Teachers must therefore head and encourage them to acquire mathematical literacy and to develop their potentials to think correctly. However, teacher may not always be held responsible when students are unsuccessful in learning subject matter. Sometimes circumstances prevent even the best treatment from resulting in desirable outcomes.

It is important to understand that a lawyer may lose a case or a patient may not be cured, not because a lawyer or doctor is incompetent but because the treatment is not sufficient to overcome the difficulty or because the advice of the professional is not heeded." Similarly, a teacher's strategy may represent the best that can reasonably expect but it may not suffice for observable students' progress.

In order to solve these problems of students' poor performance in mathematics, the following recommendations are made.

7. RECOMMENDATIONS

Teachers should always encourage their students to ask questions on any aspect of the topic they are teaching before proceeding to the next step or topic. They should relate abstract ideas or concepts to real life activities. Mathematics Teachers Association and individual teachers should be encouraged to write books and conduct researches on how to encourage students in the study of mathematics.

Government should take into consideration the provision of relevant textbooks and teaching materials to enhance the teaching and learning of mathematics. They should also make fund available for the provision and maintenance of these materials. Government should also create parents: Education forum. This is to educate the parents of the need to supply their children with all the necessary materials needed in encouraging the study of mathematics.

In-service training to mathematics teachers in order to ease the problem of shortage of mathematics teachers in our secondary schools should be provided, and should regulate the frequent transfer of mathematics teachers. Principals of various schools should organise remedial classes in mathematics for students who are weak and should from time to time organise seminars on how to teach mathematics.

All mathematics teachers must be professionally qualified. All professionally qualified teachers of mathematics should receive automatic employment immediately on graduation both at NCE and Degree level.

Graduates in mathematics and statistics without teaching qualifications who wish to teach should be provided with the opportunity for professional preparation.

Thus mathematics being one of the most important subjects and a prerequisite for professional courses should be pursued with vigorous effort on time.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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