MATHEMATICS EDUCATION IN NIGERIA: ISSUES OF EFFECTIVE TEACHING STRATEGIES

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ABSTRACT
Mathematics has continued to receive attention in Nigeria since independence; this is because mathematics is the stem for scientific and technological breakthrough. It is sure that despite the effort been put in to up lift the standard of mathematics in schools the result have not been satisfactory. Different reforms have been made in education in other to improve the understanding of mathematics because of its strategic position in nation building. Many authors have raised issues that affect the understanding of mathematics to include, issues of mathematics teachers education, professional development of mathematics teacher, overcrowding mathematics classroom, challenges of mathematics strategies for teaching and sustaining mathematics learning. These views will put mathematics teachers and learners in the right direction of understanding and teaching mathematics.

INTRODUCTION
Since Nigeria got her independence in 1960, mathematics education has received and continued to receive special emphasis and attention. This is perhaps, in recognition of the indispensable role of mathematics in realizing the nation's dream of rapid scientific and technological development. Hence, Kline (1964) had posited that the importance of mathematics to modern culture of science and technology has been well recognized and accepted worldwide. This was re-echoed by Ezeilo (1975) and Fakuade (1977). According to Ukeje (1977), the increasing importance and attention given to mathematics stem from the fact 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 indispensable single element on modern societal development. This suggests that there could be no real development technologically without a corresponding development in mathematics both as conceived and practiced. As it is rightly observed in Bajah (2000), no nation can make any meaningful progress in this information technology age, particularly in economic development without whose foundation are science and mathematics.

Like a barometer, the scientific and technological capability of a nation has easily become the social index and determining factor for assessing the economic progress, prosperity and power of nations. Nigeria, despite her status as the world's sixth largest producer of oil and possession of other vast reserve of natural resources, is still operating far below her economic capacity; very recently,

a world bank report captured the paradox of our national under-development poignantly in a statement that Nigeria is a rich country whose vast majority of her citizens live below poverty life line when measured against the indices prescribed by the united nations. For Nigeria to take her rightful position among the committee of nations, there is an urgent need to have indigenous critical mass of trained scientists and engineers. Invariably, such critical mass can only be acquired by a well organized science and mathematics programmes at all level of school.

Furthermore, the current effort of the Federal Government in this direction is noteworthy (Federal Republic of Nigeria, 2000). However, despite government's effort at both state and Federal levels to promote science and mathematics, much of what passes for the teaching and learning of these subjects in our secondary schools today is far from being satisfactory. This phenomenon casts doubt on the country's aspiration of becoming a technological giant, at least in Africa. It is against this background that this paper was conceived to appraise the state off mathematics education in Nigeria, its input on technological development and also proffer some intervention strategies of demystifying the subject in the Nigerian classroom.

Overview of Mathematics Education in Nigeria

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 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. 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 trends have always been necessitated by the realization of the role mathematics should play in 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 issues of mathematics in Nigeria and attempted to look at the vision and nature of mathematical instruction, and the challenges of mathematics in the 21st century in Nigeria.

Issues of mathematics Teacher Education in Nigeria

According to Farrell (1979) no mathematics educator minimize the complex problem of preparing teachers, who do in fact, teach mathematics better. This case is applicable to mathematics teaching and learning is schools in Nigeria. Probably teachers of mathematics teach "better" mathematics but still do not teach mathematics better. Usually, much attention is/focused on teacher's subject matter knowledge. This does not allow teacher educators to pay the needed attention to the pedagogical component of teacher education. The wave of attention on the knowledge of a discipline is also found in several mathematics education programmes. As submitted by Farrell (1979) an in-depth understanding of the mathematics being taught is a necessary; but not sufficient condition for effective teaching of mathematics. This implies that in addition to teachers' knowledge of the subject matter of mathematics, there are diverse competencies involved in the teaching of mathematics to students. Moreover, a question which always comes to the open is 'what relationships exist between knowledge of context of mathematics and ability to communicate that context to learners? This is the issue raised in this paper and attention is begging focused on secondary school mathematics teacher education.

A competent mathematics teacher will be a teacher with good academic and pedagogical background, who is not easily worn out by the "system" Sizer, (1984). Based on this terse definition Farrel (1979&1984) derived the indicators of teacher competency in mathematics teaching and learning. The two types of competencies were identified by Farrell (1984). The first type is characterized as mastery types, and the second type is labelled developmental types. Moreover, it

was suggested that the first type of competency is a specific capability that secondary school mathematics teachers should certainly possess.

Professional Development of Mathematics Teachers in Nigeria

Teachers' professional development has two main phases: initial preparation and continuing professional development. Initial teacher training most often takes the form of full-time residential pre-service programmes in teachers' colleges or universities. Initial training may also be available to serving unqualified teachers through distance education, 'out-of-school' programmes during vacations or on release from schools for extended periods of time. The professional components of initial teacher training programmes can be either consecutive or concurrent with academic subject.

Continuing professional development of teachers comes from various sources and agencies, and in various forms: orientating teachers to curriculum or examination changes, upgrading qualification levels, donor-funded projects, professional teachers' associations in developing subject teaching (e.g Science Teachers' Association of Nigeria 'STAN'), or sometimes teachers' unions, school based improvement initiatives, or individual teachers working to improve their qualifications, career prospects or teaching skills. Continuing professional development may be regarded as all forms of 'in service', continuing education', 'on-the-job-training', 'workshop', 'post-qualification courses' etc.

In 2005, there were not enough teachers to staff all primary schools, particularly in rural areas and slums. And, more than half the teachers were unqualified. Adding to the problem, most serving teachers had not updated their skills in years. In 2006, the Federal Teachers' Scheme and nationwide Capacity building were introduced. These programmes work in tandem to put more teachers into schools and improve the quality of teaching. Also in the last five years, Nigeria has tackled two major problems in basic education: the chronic shortage of qualified teachers, especially in rural areas, and the dire quality of education children receive in primary school. With gains provided by debt relief the Government launched initiatives that have put 74,000 new qualified teachers in primary schools and boosted the skills of more than 400,000 serving teachers. There are 40,000 serving teachers, 40,000 National Certificate of Education graduate interns placed in primary schools in 2006, 34,000 in 2009, 5,000 focusing on junior secondary sciences in 2007, and a further 5,000 in 2009. 38,868 graduates completed their two-years teaching internships successfully in 2008 25,686 now have permanent teaching posts in the Federal capital territory and the States (NBS, 2012). Despite these efforts, there seems to be inadequate quantity of professional mathematics teachers in Nigeria.

Mathematics Classrooms

Class overcrowding in urban primary schools is gradually reducing towards the national norm of 35 pupils per teacher. This will improve the quality of teaching, which has declined over the years. Importantly, progress towards MDGs 2 and 3 education targets and educating Nigerians to play their part in achieving Nigeria Vision 20:2020 is on course.

Challenges of Mathematics Education in Nigeria

The road to better mathematics education is tortuous and difficult (Salau, 20002). Despite the importance of mathematics, many issues seem to bother on mathematics education in Nigeria. This has resulted to the consistent poor performance in senior school certificate examination (SSCE) in the subject (NERDC, 1992; Salau, 2002). Prominent among these problems, according to STAN (2002) are:

- (i) Acute shortage of qualified professional mathematics teachers
- (ii) Exhibition of poor knowledge of mathematics content by many mathematics teachers
- (iii) Overcrowded mathematics classrooms
- (iv) Adherence to odd teaching methods inspite of exposure to more viable alternatives
- (v) Students negative attitude towards mathematics
- (vi) Undue emphasis on the coverage of mathematics syllabuses at the expense of meaningful learning of mathematics concepts
- (vii) Inadequate facilities and mathematics laboratories in our schools, to mention but a few.

This catalogue of problems do not create conducive environment for mathematics education to thrive in this country. In order for science and technology to take its firm root in our society, the poor state of mathematics education must be redressed. This could be achieved by demystifying the subject in the Nigerian classroom and incorporating the enhanced strategies for this laudable goal.

Strategies for Teaching and Sustaining Mathematics learning

The alarming poor state of mathematics education in our schools, as revealed by the students' dismal performance in public examinations such as SSCE and JAMB, calls for an urgent need to constantly seek ways of improving the teaching of the subject. Such efforts could be geared towards evolving new strategies and total transformation of the mathematics education programmes. For the benefit of this paper four strategies out of many conceptualized by the author have been put forward for consideration.

1. Grouping into students ability

Grouping for instruction within the classroom, that is, dividing a class into smaller homogenous ability groups and instructing each group separately is an instructional device designed to facilitate learning, particularly in reading and mathematics. Such an instructional strategy is by no means popular in the Nigerian public schools. In these schools, mathematics is taught to large heterogeneous students, that is, students with varying abilities. Research findings (Halliman and Sorensen, 1985; Salau, 1996) have shown that large classes have the tendency of limiting the performance of mediocre students in mathematics since high ability students will always dominate in such classes.

One sure way of tacking the problem posed by large closes in mathematics in Nigeria Schools is by organizing students into smaller homogenous ability groups. The benefit of such ability grouping is argued to come about in two ways. The first lies in the increase in the teacher's ability to obtain and retain students' attention and interest where there are fewer of them in the instructional group. The other advantage is an increase in the teacher's ability to adapt methods of instruction and instructional materials to the aptitudes preparation of individual student. In other words, it allows the teacher to teacher to teach the knowledge, skills and understanding in ways that suit the students' ability, it can also be argued that if indeed groupings increases learning and if learning increases ability to learn, then grouping would also increase ability. Indeed, as has been shown in Salau (1996), the small ability group learning tends to facilitate high achievement across different ability groups. As noted in Salau (2000), paying special attention to students' interest, individual strengths and weaknesses as well as remedying their learning deficiencies may well be the right path of projecting mathematics learning as existing to the vast majority of students.

2. The Strategy of Constructivism

In the views of Epstein (2002), constructivism had been labeled as the philosophy of learning that proposes learners' need to build their own understanding of new ideas. Fosnot (1996) and earlier described constructivism as a theory about knowledge and learning describing what knowing is and how one comes to know. According to Green and Gredler (2002), the basic assumption in constructivism is that children learn when they are in control of their learning and know that they are in control. The first major contemporaries to develop a clear idea of constructivism as applied to classroom and childhood development were John Dewey and Jean Piaget. However the principles of constructivism encapsulates the following-learning is an active process, people learn to learn as they learn, physical actions and hands- on experience are necessary for learning, learning involves language, learning is a social activity, one needs knowledge to learn, learning is not instantaneous, the key component to learning is motivation. A careful perusal of the principles of constructivism showed that its adaptation to

mathematics teaching and learning will go a long way to enhance mathematics education. A situation where students who are exposed to mathematics learning become well motivated and understands the language of mathematics, then the results of the teaching-learning process will be maximized. The principle of constructivism imbibes the idea that for students to learn and sustain their learning, they must be in control of their learning and know that they are in control. Mathematical concepts must be divided into hierarchical bits in order for the learner to be in control from one bit to another having a perfect knowledge of the preceding bit. This process enables the learner to move to the next stage of the learning process at his/her own pace, thereby enabling proper understanding of mathematical concepts.

3. Use of instructional aid and games

The use of teaching aids and games in the teaching and learning of mathematics cannot be overemphasized. This is because mathematics by its very nature is abstract and extra effort is required to bring students to understanding concepts, principles and applications. More specifically, many principles and concepts in mathematics are not easily explained with common sense deduction, this obviously adds to the difficult students encountered in the comprehension of mathematics generally. Notable examples of these concepts are symmetry, place value, addition, subtraction, number system, geometry, probability as well as longitude and latitude to mention but a few. The abstractness of these concepts requires so much recourse to using concrete instructional aids and games. Furthermore, a major problem militating against improvisation in Nigeria is lack of adequate professional training of teachers. As is was known, improvisation demands adventure, creativity curiosity and perseverance on the part of the teacher. Such skills and competence are only acquired/gained through well planned training programme on improvisation. Another factor that could hinder improvisation is lack of funds. Whatever the hindrance, it is more beneficial to improvise where the real apparatus is not available than to present mathematics lessons without teaching aids.

Opinions have been expressed that when the mathematics taught is dull, confusing, trivial and makes limited and sometimes meaningless 7 and narrow demands on students' intelligence, capabilities and talents, learning is bound to be stunted if it occurs at all (Ali, 1987). As experience has shown, young people nowadays pay attention only to what seems interesting. Therefore teaching mathematics through the use of games and concrete instructional materials should be encouraged. Such mode of teaching mathematics tends to arouse curiosity and interest of the students and lays a foundation for creative, imaginative and investigative mind geared towards problem-solving in the students.

4. Computer-aided instruction

Computer-managed and computer-assisted (CAI) in individualization and mastery learning have proved to be more successful instructional strategy than the traditional chalk and talk approaches'. One major characteristic feature of the CAT is that it is interactive. Proper individualization of instruction is enhanced when a student can control his/her learning in terms of choice of materials and in accordance with his/her intellectual ability. Mathematics stands to benefit immensely from this mode of instruction. Result of studies carried out in mathematics showed general improvement in attitudes and achievement (Krans 1981; Uduosoro and Abinbade, 1997). With CAT, students' grasp of the subject-matter is enhanced especially with low achievers (Mevarech, 1993). Regardless of the educational merits or otherwise of computer assisted instruction, such innovation cannot take place by itself. There must be a computer base from which to work, and a computer system of the size needed for the CAT. The computer is not only a tool that may be used to assist in instruction,-the computer itself is something students need to know about and, in secondary schools particularly, many courses can be offered on aspects of the operation of the computer. With the publication of the national policy On information and communication technology and the setting up of an 18-member implementation committee by the Federal Government in January, 2002, it is our hope that computer will soon become available in schools sooner than we expect; thus keeping CAT within the realm of curricular possibility in Nigeria secondary schools.

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 student experience 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).

CONCLUSION

An attempt has been made in this paper to highlight the strategies for effective teaching of mathematics which is an indispensable tool for technological development in Nigeria. If the various strategies of stimulating the interest of students in the teaching and learning of mathematics are put to use in any country, including Nigeria, a great deal of change may be seen. It is equally possible to have a negligible impact if they are not used within the framework of a strategic plan. One major step in this plan is the availability of academically competent professionally trained, highly motivated, versatile and enduringly committed teachers. The implication is that our teachers of mathematics need to have the right training and orientation for teaching mathematics using the naturalistic approach in order to remove the emphasis on abstraction attributed to mathematics. The task falls on our teacher training institutions to retrain science and mathematics teachers for the challenges posed in science and technology in Nigeria. It is desirable that such institutions establish mathematics resource centre for the purpose of exposing trainee teachers to the necessary knowledge and skills. It is also worthy of mentioning that the morale of our teachers is generally low. There is need for government to show greater political commitment to professionalize teaching with attractive remuneration and better conditions of service. While teachers' welfare is appropriately tackled, we all have to abhor a development in which only those incapable of teaching will have taken to mathematics teaching.

REFERENCES

Abiodun, R.F.A. (1997). "The challenges of mathematics in Nigeria's Economic Goals of Vision 2010., *"Keynote Address Presented at the 34th Annual national conference of the mathematical Association of Nigeria*, Sept. 1 – 6.

Adeyegbe, S.O. (1987). "Mathematical Competence as a predictor of Performance in Solving Chemical Arithmetic problems at Ordinary Level." *Journal of Research in Curriculum, Special Edition* 2:23-30.

Aguele, L.I. (2004). Remediation of Process Errors Committed by Senior Secondary school Students in Sequences and Series. Unpublished Ph.D Thesis, UNN, Nsukka.

Aguele, L.I. (1990). "Towards a Humanistic Approach to the Teaching and learning of mathematics in the 90's" *31st Annual Conference Proceeding of STAN*. Pp 151 – 155.

Baiyelo, T.D. (1987). "Difficulties in communicating science: A Review of studies in Pupils Understanding of some Aspects of mathematics." *Journal of Research in Curriculum, Special Edition,* 2:77-89.

Harbo-Peters, V.F.A. (2000). "Mathematics: Language for the New Millennium, implication to the society." *A paper presented at 37th Annual conference of MAN,* Sept. 4-7.

National Council for teachers of Mathematics, NCTM (1995). *Assessment Standards for School Mathematics.* New York: Author.

Ukeje, B.O. (1997). "The challenges of mathematics in Nigeria's Economic Goals of Vision 2010: Implication for Secondary School mathematics" *Paper presented at the 34th Annual National Conference of the Mathematical Association of Nigeria (MAN),* Sept. 1-6.