Strategies for Teaching and Sustaining Mathematics as an Indispensable Tool for Technological Development in Nigeria

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Abstract

The world of today is predominantly shaped and controlled by the overwhelming influence of science and technology with the study of mathematics as a pivot. This is perhaps in recognition of the indispensable role of mathematics in realizing the nation's dream of rapid scientific and technological development. This also portends the fact that the triangle of science, technology and mathematics should be vigorously pursued by the Nigerian government. However, Nigeria's effort to promote scientific and technological literacy are not yet yielding the required dividends because basic strategies for teaching mathematics have been down-played by various government agencies. Despite the bare fact that Nigerian children still shy away from the study of mathematics, issues in mathematics teaching strategies such the use of qualified teachers, teacher motivation by incentives and computer aided instructions should be adequately implemented. This paper addressed the issues of strategies for teaching and sustaining mathematics as an indispensable tool for technological development in Nigeria. Some innovative teaching strategies were suggested for demystifying mathematics in the Nigerian classroom. They include the strategy of constructivism, groupings into students' ability and the use of instructional aids and games. The paper concluded that 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.

Key words*: Strategies, teaching, mathematics, technological development.*

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 in 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 levels of schooling.

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 of mathematics education in Nigeria, its input on technological development and also proffer some intervention strategies of demystifying the subject in the Nigerian classroom.

Major problems of mathematics education in Nigeria.

The road to better mathematics education is tortuous and difficult (Salau, 2002). Despite the importance of mathematics, many problems seem to beset 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 and learning 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. Groupings 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 a 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 tackling the problem posed by large classes in mathematics in Nigerian schools is by organizing students into smaller homogenous ability groups. The benefit of such ability groupings 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 and preparation of individual student. In other words, it allows the 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 exiting 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) had 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 where 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 aids 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 difficulty 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 it 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 meaningless7 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 tend 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 (CA1) 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.

Conclusion

An attempt has been made in this paper to highlight the strategies for teaching and sustaining materials as 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. By so doing, we shall be engaging in the erstwhile WAR against poor achievement in mathematics (WAPAM).

References

Au, A (91987), Cognitive competence and teaching ability of mathematics teachers in Nigerian secondary schools. Journal of Nigerian Educational Research Association, 7(1 & 2) 100 — 117.

Bajah, S. T. (2000). Emerging global issues in Education. A lead paper presented at the National Conference on Curriculum innovation in the 21st century held in Abuja.

Epstein, M. (2002). Using Information Effectively in Education. On line Research Portfolio, Fall.

Ezeilo, J. 0. C. (1975). Presidential address to the 11th Annual Conference of Mathematical Association of Nigeria (MAN).

Fakuade, R. A. (1977). Mathematics as a subject. Journal of the science teachers association of Nigeria (STAN), 16 (1) 82 — 95.

Federal Republic of Nigeria (2000). The National Space Policy and Programmes. Federal Ministry of Science and Technology, Abuja.

Fostnot, R (1996). Constructivist Theory. What is knowing? Maureen Epstein's on line portfolio. Fall.

Green, W and Gredler, I (2002). Constructivism and how children learn, Maureen Epstein's on line portfolio. Fall.

Halliman, M. T. and Sorensen (1985). aass size, ability and student achievement. American Journal of Education, 94, 71 — 89.

Kline, M (1964). Mathematics in Western Culture, New York; Oxford University Press.

Krans, W. H. (1981). Using a computer game to reinforce skills in addition. Basic facts in second grade. Journal for research in mathematics education 12 (2), 152 — 161.

Mevarech, Z. R. (1993). Who benefits from computer-assisted instruction. Journal of Educational Computing Research. 9 (4), 451 — 464.

NERDC (1992). A survey of performance in pubic examination research report No. 3, Abuja.

Sa Ia u, M. 0. (1996). The effect of class size on the achievement of different ability groups in mathematics. Journal of the science teachers Association of Nigeria, 31 (1 & 2), 57—63.

Salau, M. 0. (2000). Options in sustaining mathematics as the language science and technology in the 2Vt century, proceedings of the 37th Annual Conference of the Mathematical Association or Nigeria, 41 — 60.

Salau, M. 0. (2002). Strategies for sustaining mathematics as an indispensable tool for sustaining technological development in the 21st century.

STAN (2002). Science, Technology and Mathematics Education for Sustainable Development in Africa. Note address by the Honourable Minister of Education.

Uduosoro, U. J. and Abimbade, A (1997). The place of computer-assisted in Mathematics Education. Proceedings of 40th Annual Conference of the Science Teachers Association of Nigeria, 238 — 243.

Ukeje, B. 0. (1977). The challenges of mathematics in Nigeria's economic goals of vision 2010: Implications for Secondary School Mathematics, a Lead Paper Presented at the 34th Annual National Conference of the Mathematical Association of Nigeria.