

CRITICAL FACTORS INFLUENCING THE MATHEMATICS TEACHER EDUCATION IN THE 21ST CENTURY: POSSIBLE WAY FORWARD

BY

HASSAN, A. A.
SCIENCE EDUCATION DEPARTMENT
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

ABSTRACT

Teacher Education in general and Mathematics Teacher Education in particular cannot continue as in the past while these reforms are being taken as 21st century is regarded as an era of stock taking. The purpose of this paper is to review past mathematics Education reforms and critically examined the issues and challenges of Mathematics Teacher Education in order to project what could be done to overcome these challenge. The recommendation were federal and state governments should recruit more experienced experts to lead in the development of mathematics Education program both at the Head Quarters and zonal level (ii) Teacher producing agencies should Emphasize more on recent research efforts/experiences for teachers in training (iii) regular workshop and seminars for teachers of mathematics on the recent use of relevant information and associated technologies in mathematics should be organized regularly for teachers on the field.

INTRODUCTION

The world is being transformed as a result of advances in science and technology. This was made possible through the application of certain mathematical procedures. These influences can be seen as it has brought about marked changes in our society as evidence by their diverse effects on practically all aspect of human life. It is for this obvious reasons that Nigerian government have for decades been battling with problems of general development and nation building and have long recognized that a crucial element to put in place in the development of human resources is through education and training. It is in the aspect of education that teacher education is accorded high priority as contain in the National policy on Education (2004) section 8 B, 70(a). The importance of teachers cannot be over emphasized as they are the implementers of Educational policy. The role of a teacher is summarized by Okolo, (2005) in Taylor, (1969) said:

"The role of a teacher in any society lies at the heart of its intellectual and social life and it is through the teacher that each generation comes in terms with

its heritage, produce new knowledge and learns to deal with change provided that, the teacher has been with enough education to act as transforming element"

In particular, Mathematics teacher occupies a strategic position in our current developmental effort since, mathematics is the basis of all scientific and technological advancement of any nation. The mathematics teacher has a body of knowledge to convey, part of which is necessary if individuals are to participate successfully in the life of our modern society. Mathematics also contributes to the advancement of other professions such as Accounting, Engineering, Agriculture, Banking e.t.c. To the individual, learning of mathematics provide intellectual satisfaction, the knowledge is definite, precise, logical and can be use to proof arguments which are testable and the truth determined. Hence it helps in the development of critical thought. Therefore, it can be argued that, to prepare for today's workforce, Informed about important issues, and able to understand the complex world in which we live, we must have a solid Mathematics Teacher Education, which

will equipped its recipient intellectually and professionally to carry-out the teaching of mathematics at all levels of the Education system in the 21st century.

CONCEPTUAL FRAME WORK:

The conceptual frame work of this paper is based on the problem and issues of mathematics education as evidence since independence up to date and challenges facing teacher education. This is done to assessed the past and reclaim what is good and discard what is found unsuitable for the mathematics Teacher of 21st century in Nigeria.

Therefore, this write up is segmented as follows, Introduction, the conceptual framework, Trends in Mathematics Education in Nigeria, problem of Mathematics Education emanating from the trend, challenges facing mathematics Education and strategies for Transformation of Mathematics Teacher Education in the 21st century.

NATURE OF MATHEMATICS EDUCATION:

According to Fajemidagba ((1991) it is a discipline or field of study, which deals with the problems of the teaching and learning of Mathematics at all level of Education. The mathematics education is concerned with curriculum development, instructional development and the pedagogy of mathematics. He is a mathematician of a type and does research in the areas of curriculum, instruction, learning and teaching of mathematics. He has at his disposal theories of psychology, sociology and philosophical which can be applied to the teaching and learning of mathematics. It can be inferred from above, that mathematics-education is a course specially design to produce mathematics teachers who receive training in mathematics, psychology, philosophy and teaching techniques to become educators in mathematics and facilitators in learning mathematics. Therefore the goal of Mathematics Teacher Education cannot be only to teach mathematics but also to acquire certain qualities such as learning process, skills, values, and attitudes. It is these qualities that enable him/her to show competency in the subject content, the ability to design and interpret learning programmes, manager in the classroom, to practice and promote a

critical attitude, have a committed and ethical attitude towards developing a sense and responsibility towards others and ability to integrate assessment in teaching.

TREND IN MATHEMATICS EDUCATION

The teaching of mathematics started with arithmetic in the south part of Nigeria brought by the missionaries. This is so because the white man needed natives who could read, write and calculate. Then, it was made compulsory in Primary Schools Grade III and Grade II respectively. Thus, it was compulsory before certification (Tijjani, 2001). The North started Western Education later as a result of amalgamation of North and South. By early fifties, the concept of mathematics as a school subject had developed in Christian mission schools in the south but the subject was done in three different section's as Arithmetic, Algebra and Geometry, though at that time syllabus was plan by Cambridge syndicate WAEC. By 1956, Mathematics became one single subject in the West Africa School Certificate Examinations. But Arithmetic remained as a separate subject to mathematics in Teacher Training College. Later came the move to make mathematics one and as reported by Odili (1986) supported by the argument that,

"The integrated mathematics, emphasizes the important process and concept, in mathematics rather than routine calculation. It provides alternative to solving the problem in more than one way, hence it reinforces insight in to and the understanding of the problem" Odili (1986)

One of observed serious short-coming in this transformation was in the emphasis of mathematics in secondary school and no equivalent effort to prepare the pupils for mathematics in the primary schools but rather Arithmetic and most of the teachers of mathematics then were white or a few Nigerian grade two or pivotal teachers. At this juncture, to my mind, we can not have mathematics learn and understand above that of the teacher.

After independence came, the need to have capable Nigerians who will take-over from the white man as Engineers, Pharmacist, etc. There was

population explosion in schools. Therefore, the existing mathematics curriculum was found no longer suitable to meet the needs of science and technology. This marked the beginning of the imbalance in Mathematics education between the North and the South, and the need for change in the mathematics curriculum became crystal clear.

Between 1960-1969, as reported by Fajemidagba (1991) that Mathematics Education Programme in Nigeria were also subjected to various reforms. This was the effect of the "revision syndrome" which swept across the world. This trend forced nearly all primary Schools and Teachers Training College in Nigeria to commence the teaching of mathematics. The attempt was to produce primary school teachers who could teach the elementary mathematics. In service programme were organized for service teachers for the purpose of retraining them.

Between 1970-1977 came the controversial modern mathematics though, aimed to make secondary school mathematics meaningful. However, this programme did not commence simultaneously all over the country particularly in the Eastern region. In addition, it was reported that modern mathematics was far from being successful due to lack of trained teachers to handle the curriculum and WAEC's report which indicated students' poor performance in modern mathematics paper. Again, this marked the beginning of call for a change in mathematics curriculum. Automatically, this affected the teacher-training curriculum developed in 1974 to take care of Universal Primary Education scheme. Since the coming of UPE Scheme, there was population explosion in school without adequate number of teachers. To take care of this ugly situation, the then Federal government embarked on massive admission in to our secondary/teacher schools for one or two years crash programme in Teacher Training for secondary school graduand depending in entry grade. Those with good WAEC result and have interest in teaching job were to spend one year while those whose results are not good enough and have interest in teaching were asked to spend two years. After the scrapping of modern mathematics, came in the current mathematics curriculum, which was

designed in line with the 6-3-3-4 systems in 1979.

STATE OF THE ART

Generally, it appears from historical accounts of the development of mathematics Education in Nigeria, that concerted effort on the nature of mathematics started with the Arithmetic, a component of mathematics. Late to compartmentalized mathematics (Arithmetic, Algebra and Geometry). Then to traditional mathematics and finally to controversial modern mathematics and General mathematics. However, the other side, which is on how to teach it and by whom was not given the attention it deserves. It is in the light of these that one may tend to agree with Adetuls, (1987) who observed that the most immediate problem is not the mathematics curriculum but the need for better qualified effective efficient mathematics teachers, since he is the main channel of mathematical ideas to the learner. For this single reason, the task force set up in 1976 under the auspice of NERDC agreed that, the task of teaching mathematics had been further aggravated by the inadequacy of teachers and increased enrolment at the primary and the secondary school level of the system.

The consequence of these have been the cumulative evidence which point to the fact that secondary school students are under achieving in mathematics. (Okolo, 2005).

Harbor Peter (1992) buttressed this and said the observed poor performance is not only limited to secondary school students but also to the primary and secondary school mathematics teachers. Similar opinion were Expressed by Odili (1992) who said, although the new policy is not salient on teacher Education, the provision for Teacher preparation do not seem to match up with job requirements.

CHALLENGES FACING THE MATHEMATICS TEACHER

Mathematics Education has undergone series of transformation since independence. The transformation efforts were aimed at improving the nature of mathematics, mathematics learning and teaching. It appears that, these are the forces that continue to influence our reform efforts in mathematics education. The one that is most important to our

discussion is the mathematics teaching done by the mathematics education/teachers. It is in the light of this that the paper will briefly identify some other forces that serves as challenges in our effort to prepare the mathematics teacher in the 21st century.

a. Nature of Mathematics

Mathematics is dynamic so it grows as the need of the people arises. According to Handal (2004), this age old discussion is far from being conclusive, rather it is evolving as each thinker contribute his/her view of looking at the different facet, which mathematics present as a discipline. The question here, is what will be the nature of mathematics for the mathematics teacher of the 21st century? I will suggest that our reform efforts in Mathematics Teacher Education/Programmes should enable prospective teachers to inculcate in the students/pupil the following.

- Learn to value mathematics
- Become confident in their ability to do mathematics
- Learn to communicate mathematics
- Learn to learn mathematics.

Attempting to prepare mathematics teacher programmes as above, the prospective teachers will make the students/pupils to be active participants as mathematicians, creator of mathematics and evaluator of mathematics that has been created and solved by themselves. Therefore, there is the need to revitalize the mathematics teachers education in the aesthetic and ethical values of mathematics towards strengthen their human qualities and improve the achievements.

b. Learning of Mathematics

Historically, it was the believe of many mathematics Teachers that Arithmetic/mathematics are best learnt through memorization of facts. Hence an individual's power of memory and ability to retain and recall could be improved by exercising them. In other words, by being made to learn anything relevant and useful. Such and extreme view is not now acceptable though the value of practice/exercise might not be completely rejected.

The debate on how individuals learn mathematics is still on. Handals (2004) reported that a personal philosophy of mathematics Education ascertains the way we learn and teach mathematics within the classroom and school environment. This is to say that students learn mathematics based on the teachers belief of how he was taught and appears to him as the way the teacher understood the topic. If the belief is that, students learn better through practice to produce correct responses, then, the teacher should gives him/her more Exercise/practice. If however, the belief is that the student learn better through making sense of the world and wish them to discover the essential relationships through interaction with an appropriate environment then, the teacher provides structural and other apparatus, devise activities and experiences that allow exploration of situation.

However, Orton (1992) and other modern psychologists such as the constructivists suggest that, learners do not remember material exactly as it was taught, that they reconstruct their own meanings and that retention involves an active process of reconstruction. Therefore, the challenge before the mathematics teacher is on how best to inspire the learner to choose to learn mathematics as many learners had the belief that it is a difficult subject and they try to avoid it. Hence, the writer suggest that, mathematics teacher has the responsibility to collect enough evidences on how the different individuals in his/her class can be inspired positively towards learning the subject. This can be done through creating dynamic learning environments which attempt to strike a balance to meet the need of the curriculum and his/her deeply held belief.

c. Mathematics Teaching Technique

Historically, the Arithmetic/Mathematics handed down by the colonial masters did not lay emphasis on the importance of mathematics from the history of mathematics Education development in Nigeria. It has been shown that the textbook, and the materials used were not suitable, many illustrations were not adequate and did not reflect meaningful experience to the learner. Hence, they did not employ satisfactory teaching/delivery technique. Ojo (1986). This in herited problem continue up to the

period of modern and General mathematics as teachers were not adequately trained in the methodology of teaching even when there were changes in the nature of mathematics (content). The result is observed in the continue poor performance of students in mathematics, (Aburime, 2003)

However, research findings have shown that there is no one best method of teaching. For instance, Adetula (1987,1994) reported that there are two categories of teaching strategies adopted by the primary and secondary school teachers in teaching mathematics, namely the drill and matching analysis teaching technique. Furthermore, Hejeto (1992) opined that the evidence at our disposal for now tends to attest to the fact that the application of appropriate methods in mathematics teaching is a necessary and perhaps sufficient condition for the lesson to be successfully implemented assuming a fair mastery of the subject matter taught by the teacher. Similarly, from the writer's experience it is clearly perceivable that effective explanation and assessment of classwork, assignments is a function of the teaching method adopted by the teacher.

Therefore, the mathematics Teacher Education of the 21st century should be prepared to make teachers teaching style dynamic by choosing among the various new suitable methods at his disposal. In particular, the use of ICT, concept mapping, questioning technique etc which in cooperate principles of dynamism, construction and perceptual variability

This could be attained in a teaching style that permits the learner to handle, observe and experiment with material and allows him to compare past experiences with new one so as to enable him take new decision or amend his old precepts and adding new one.

OTHERS

The Challenges in these categories to be face by the mathematics teacher education include:

i. Language in Mathematics:

English language is the medium of communication when teaching mathematics in our classroom. However, as reported by Bolaji (2000) researcher have shown that the learning of primary mathematics requires a lot of linguistic

skills that second language learners may not have mastered. At the primary and secondary school level the effect can be observed when a learner cannot do the mathematic because the particular language used is not understood. Hence, ability to comprehend English language and ability to handle mathematical language as these are identified to be responsible for the difficulty in solving word problems as well as algebraic Expression, Obioma (2005).

ii. Large Class Syndrome:

Virtually in all public schools visited today, one would find an over-populated mathematics classes. This is further aggravated by the fact that these classes are made up of pupils/students from different home background and with varying abilities. This is also an indicator of our transformation and reformation in our Educational System. The present civilian government has just flagged off the Universal Basic Education Scheme/Programme. It is expected that, more number of pupils have enrolled in the schools and which means more mathematics teachers. The challenge for mathematics Teacher Education is to ensure that, the mathematics teachers of the 21st century is exposed to several ways of tackling the problem posed by large classes in mathematics instruction. For instance teaching technique that involve students to work on activities in small heterogeneous group and often receive rewards or recognition base on the overall group performance can help in the management of large classes. Sadker and Sadker (2003) reported that the students develop team learning method in which the team work is not complete until all students in the team understand the material studied which make student to have higher achievement gain in mathematics and English.

iii. The Use of Technology:

Advances in science and technology through mathematics have lead to development in information and communication technology. Okolo (2003) and Obioma (2005) have evidence to confirm the report that when information and communication technology is used in the training of mathematics teachers, it will enhance the educational process and equip each learner with an exciting medium for problem solving and improve

student achievement in mathematics, Example is the CAI we site, e-mail etc.

CONCLUSION AND RECOMMENDATIONS

In conclusion, the teacher is a powerful force to be reckoned with in any educational system. Mathematics Teacher becomes more important in this era of science and technology. Therefore to prepare mathematics teacher for the unforeseen circumstance of the 21st century there is the need to study there past so as to position ourselves and get prepared for the future. Therefore a brief history of mathematics education was given. The nature of mathematics, how individual learn mathematics, mathematics teachers Teaching technique and others were perceived and seen as the likely guide in our future mathematics Teacher Education development of the 21st century. It is on the light of these that it is the light of these that the following suggestions were made for the Mathematics Teachers Education of the 21st Century.

1. The federal and state ministries of Education has done a lot in their commitment towards the enhancement of mathematics Education. However, more is needed and expected in terms of human and material ie more number of Experts in mathematics Education to head the affairs of mathematics Education in the head garters and zonal levels there is also the need for more financial efforts in the developmental both curriculum and instruction programmes.
2. The agencies such as college of Education Universities, National Teachers Institute (NTI), etc who are concerned with mathematics Teacher preparation should by more emphasis on the programme of Teacher Education in the area of Research particularly Action research so that they can observe and report on how there practices (methodology courses,) are transferred in to actual teaching. This is because research experience has the potential to generate motivation which is relevant to the professional practices of teachers.
3. On a regular basis workshops and seminars should be organized by agencies such as NERDC, NTI and other professional Associations such as MAN,

STAN. This would expose the participants to current information and their uses. These latest information and associated technologies in the field are powerful approaches to teacher development in the 21st century, Okolo (2003).

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