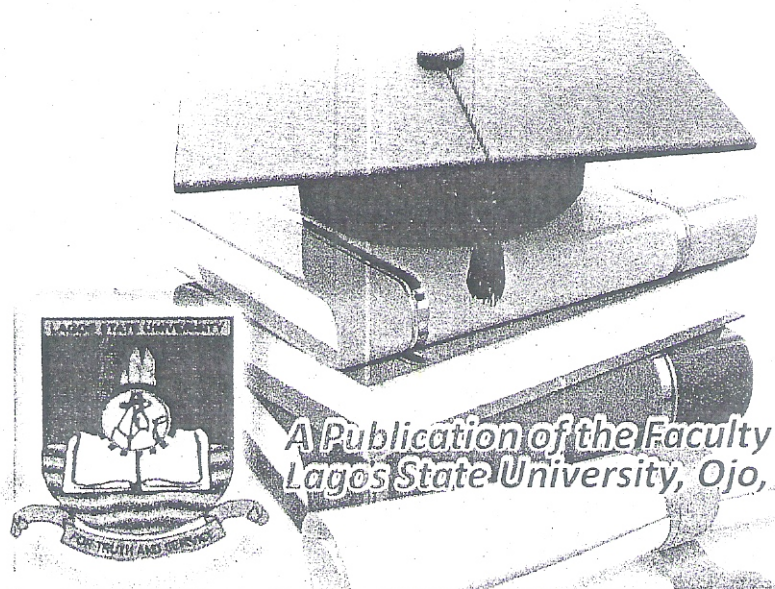
EDUCATION:
A MULTI-DISCIPLINARY APPROACH TO IMPROVING QUALITY OF LIFE

A book of readings in honour of

Professor
EMMANUEL ADEREMI AKINADE



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Nature, Place and Role of Mathematics Teachers for the 21st Century of Nigerian Economy

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Abstract

During the past decades, mathematics and mathematics education have undergone a rapid changed, given rise to polarization of opinions among the community of researchers on the nature, place and role of mathematics vis-à-vis the a pedagogical tenet. Shades of opinions tend to make distinctions of what the nature and role of the subject to be in line with the need of concerned communities as to the appropriate balance between mathematics education and its relevance to the national development? Its roles and that of mathematics teachers in national development, and how to ensure mathematics education plays a leading role in the national development? These among others were the focus of the paper by presenting serious discussions on these, with a mindset of making mathematics education more relevant and appropriate for a sustainable national development.

Keywords: *Nature, place, role, mathematics, teachers, Nigerian economy*

Introduction

Education could be referred to as a strategy that promotes creativity among the citizens. Creativity implies helping people to fulfill their potentials and rise to the highest level of their capability. Educational systems throughout history have focused on two issues namely the transmission of values from the past to the present; and at the same time promotion of the future. But what everyone is concerned with is level of creativity needed for oneself and that one expected of one from the larger society. As society might not be a safe place to breed students to become bright scientists and creating new instruments of oppression and mass destruction on one hand, and violating human dignity. This has been the watch word of the past and present educators in an attempt to combat myriad of problems associated with modernization. The strategy of any educational systems to pursue the goal as

transmitted into need by the designed curriculum. Curriculum is usually organized linearly and in most cases in three strands: objectives, contents and methods. Thus, the curriculum emerges from the acceptance of the social aims of educational systems out of which the identification of contents help to reach the goals and the development of methods to transmit these contents into realizable objectives (D'Ambosio, 2001). Without any doubt, Mathematics is generally accepted to be the foundation success in a variety of content areas during a child's educational experience. This is why Mathematics is crucial not only in school, but in being a tool to turn an informed citizen, productive and successful in one's chosen career that assisted one in personal fulfillment. This is why in today's technology-driven society, greater demands have been placed on individuals to interpret and use mathematics to make sense of information, technology and complex situations (Donovan, 2005).

Research has shown that majority of the students' perceived mathematics as a very boring subject and they do not see it as getting them job opportunity or being useful to their immediate environment, their country and so learning it with all the needed zeal has been considered as useless. As students get older, they start to perceive mathematics as a subject for the brilliant ones and as a subject one either passes or fails (Martorell & McFarlin, 2010). In fact Mason, Burton & Stancey (1982) found that many students agreed that mathematics is important but the interest in taking mathematic courses decreases as they progress through school. By the time students reached the college, they have already formed conclusions regarding their success in mathematics. It is also obvious that insisting on the three R's which prevails in most school systems make mathematics education irrelevant to the current agitation for change. This is to say that another emphasis, which focuses on relevant issues of today's society, responds to youth intellectual curiosity and agility, and prepares them for a future, which we can only guess how it will be, is required. Making mathematics education a ladder for a sustainable development is most paramount and so attention should be shifted from insistence on obsolete mathematics teaching methods.

It is indeed an established fact that Galileo highlighted mathematics as the language of nature and various common wealth countries understood it as the queen of all sciences. This underlies various importance placed on it as tool for technologies in USA and most other industrialized nations. Virtually all the major breakthrough in science and technologies such as landing on the moon, invention of television and fax machine, planning and designing of rockets and satellites, planning and determining strategies of war, manufacturing of sophisticated weapons and armors, invention of computers and their various variants, scanning of brain, manufacturing of powerful telescope, weather forecast, prediction of stock markets, are mathematically inclined technology and mathematical brain (Hassan, 2008). As a result, the paper examined the

nature, place and role of mathematics-education for the 21st century with reference to Nigerian-economy.

Nature of mathematics for scientific and economic development

It has been observed that many topics in Mathematical Sciences have not attracted the attention of academicians in Nigeria compared to what has been obtained in some of the Arab states. Though concrete steps that were suggested to popularize these topics should be adapted in Nigeria in order to launch the nations' classroom interaction among the students. According to Hassan (op cit), the establishment of the Society of Industrial and Applied Mathematics, in Philadelphia, U.S.A. in 1952 was a serious effort to enhance the role and involvement of mathematics in the investigations of industrial and real life problems. Apart from this, International Congress of Industrial Mathematicians (ICIAM) that was established with its first conference in Paris (1987), second in Washington D.C. (1991), 3rd in Humburg (1995), 4th in Edinburg (1999), 5th in Sydney (2003), 6th in Zurich (2007) and 7th (yet to be scheduled) in Vancour (2011) pointed to the fact the subject is given premium position. Every industrialized country has its national society for developing industrial and applied Mathematics. For instance, India and China joined ICIAM in the mid-nineties while the International Mathematics Union, American Mathematical Society, European Mathematical Society and Russian Mathematical Society have also joined this organization. The main goal of this organization is to promote the branches of mathematics that are more relevant to the economic and scientific development. In her deliberation of 16-20, July 2007 at Zurich ICIAM07 focused its attention on the following themes:

(i) Computing (including: Computational Science and Engineering, Scientific Computing, parallel computing, high performance computing etc).
(ii) Applied Analysis (including integral and functional equations, Fourier and Wavelet analysis, perturbation methods).
(iii) Optimization (including optimization with PDE, complimentarily problem, variation inequalities, security and defense).
(iv) Stochastic PDE and Numerical Methods such as finite element method, boundary element method and particle method.
(v) Image Processing, Fractals, and Wavelets.
(vi) Financial Mathematics.
(vii) Data Analysis.
(viii) Discrete Mathematics (including integer programming, network).
(ix) Elasticity and Plasticity.
(x) Material properties and microstructure.
(xi) Molecular modeling.
(xii) Flow through porous media.
(xiii) Applications of mathematics to agriculture, ecology, epidemiology, tumor and cardiac modeling, DNA sequencing, gene technology.

(xiv) Applications of mathematics to meteorology, earthquake, tsunami, hydrocarbon exploration.

(xv) Semiconductor and superconductor.

(xvi) Modeling and simulation for industry including manufacturing, micro-scale, inverse problems.

(xvii) Application to culture history and civilization.

Though there might be many more topics in mathematics that could be applied to solve real world problems yet all these topics are put under the Umbrella of Industrial and financial mathematics. For the Industrial Mathematics topics comprise three steps namely the description of a situation in words and its mathematical formulation, Mathematical equations or concepts representing the situations as referred to as models. Analysis and finding exact solution of the model and finding approximate solutions by discrediting models, if possible, Visualization of solutions on screen of the computer, and (iv) Interpretation of solutions. Along this line are the emerging technologies and challenging real world problems that are classified into Advanced materials, Advanced semiconductor devices, Artificial vision and intelligence, Bio-technology, Digital image technology, Flexible integral Manufacturing, High density data storage, High performance computing, Medical devices and diagnostics, Optus-electronic, Sensor technology, Super conductors, Neon-technology, Simulation of processes and products, Optimization and control, Uncertainty and Risk, Management and Exploitation of data, Food and Health related problems where Mathematics has been successfully used in all these areas.

Place of mathematics for scientific and economics development

By application of mathematical methods the exploration cost of oil and communication cost of images could be reduced. Techniques of wavelets and fractals are used for this purpose. Numerical simulation of mathematical models for type – II superconductivity 24-27 February 2008, may help to manufacture super conductor cables to reduce the cost of electricity. Knowledge of Maxwell's equations and variation inequalities are required for a systematic study. Scientific computing, optimization, wavelet analysis, stochastic analysis, signal and image processing are some of the areas mentioned above which could be particularly useful for economic and scientific development of Nigeria as a giant of Africa as it was suggested for Arab states (Hassan, 2008). Researchers are convinced that topics in mathematics mentioned above could reduce substantially exploration and production cost of hydrocarbons. It is well known that above 70% of today oil and gas production rate comes from hydrocarbon field that are more than 30 years old. Managers and researchers of oil industry are engaged in developing new technological methods, based on contemporary mathematical methods and scientific tools from areas of geophysics, geology, petroleum engineering, signal processing and computer science, which may improve economic conditions of Nigeria as

an oil producing country and consequently also of other developing countries. Electricity is the source of all developmental activities. Increase in the cost of electricity increases the cost of living in any country. Reasonable price of electricity is the need of any country in the world. There are attempts in different parts of the world to develop superconducting materials at high temperature to produce cheap electricity. For proper understanding and utilization of superconductors at high temperature, besides chemistry and physics of this phenomenon, new mathematical models and methods are needed. The main goal is to manufacture superconducting power cables and if Nigeria government devotes enough resources into manufacturing superconducting power cables, there will be great improvement in the power supply sector. Neon technology is becoming a popular theme through out world. However, understanding the mathematical rigor, an important ingredient for any minute details in neon-technology and its special impact, is missing. According to Hassan(Op cit), an interesting symposium (IC/MP39/154) on Neon-mathematics was organized during ICIAM07 [13] by Leela Rakesh (Central Michigan University, USA). It was to support the emerging neon-technology and neon-science revolution through an interdisciplinary mathematical modeling and simulation that applied to the understanding of Biology, Chemistry and Physics of neon-materials. The US Department of Energy has identified a key potential research target for future development of the field: "lack of development of theory, analytic techniques, modeling and simulation tools. The symposium was mainly devoted to the basic understanding of fluid dynamics and better analytic techniques, thus enabling the better design, modeling, predictability, efficiency and control of systems that involve fluids. Mathematicians and mathematics educators in Nigeria have to also play an important role in this emerging field.

The challenge of mathematics curriculum contents towards technology

The digital revolution presents what mathematicians have seen as an unprecedented need to rethink of the mathematics curriculum. Traditional way of routine calculation is becoming the work of machines, rather than people. Basic arithmetic for buying and selling, statistics for a community group, graphing in school mathematics and algebra for an engineer - all are becoming affordably automated. One is forced to make a correspondence between strings of numbers and points in space and it was not ordinary space, but multi-dimensional space. This poses enormous challenges for mathematics in schools, especially in deciding what to teach and to whom. The content that has been the backbone of the school curriculum in the twentieth century is the teaching of routine algorithms. It may not have been done as well as we may like, but routine procedures are possibly the easiest part of mathematics to teach. If the success of education systems worldwide is taken as evidence, then it seems that this is rather easier to teach than sensibly using algorithms, estimating answers, deeply understanding concepts and seeing how they could

be applied. These goals have long been recognized as the most important goals of schooling. In the new technology environment, pursuing the other goals will be of little value. The presence of four function calculators (most likely embedded in objects) will eventually lead to a thorough reassessment of arithmetic and the new algebra technology will lead to a re-assessment of most of the standard fare of secondary school mathematics. To give just one example, our recent research project "Learning Algebra" at the University of Melbourne has attempted to uncover some of the ways in which algebra teaching need to change (Stacey and MacGregor, 1997). One need to look at two aspects of algebra that one believes to remain fundamental.

Reading and writing the language of algebra precisely seems essential, as a way of communicating with machines, so that problem situations can be described and solutions can be interpreted in human terms (MacGregor & Stacey, 1997). However, formulating problems algebraically (usually as equations) presents cognitive challenges far beyond the language aspects. For example, identifying the variables involved and noticing functional behaviour and necessary relationships are difficult steps as requiring a new "algebraic" way of thinking, not just an extension of arithmetic thinking into a domain of letters (Stacey and MacGregor, 1997a).

Abstract mathematical ideas, which probably seem intensely abstruse to a novice, are paradoxically useful and yet all mathematical ideas are abstract. Even when a pupil first learns addition, the addition of the numbers is abstract, not concrete. The teacher may put 6 objects in front of a pupil and add another 2 of them, but the addition lies in the putting together, not in the objects that can be seen or felt. Perhaps surprisingly, successful mathematics learners do not feel that mathematical objects are abstract (Mason, Burton and Stacey, 1982). Making abstract entities feel concrete is the perennial problem of mathematics education. The feeling that these abstract mathematical concepts are somehow concrete is and a sign of understanding. Teaching rules without reason cannot create it. One example of this is when one encounters in research study on the learning and teaching of decimals with rounding numbers. Too often, students are taught to round numbers just by rule: if the digit following the one wants is less than 5, knock it off otherwise increase the last digit one wants by one.

Disappointingly, some textbooks explain the ideas no better than this. It seems likely that one of the reasons why such as simple rule as the rounding rule is so badly remembered and why significant figures are so much abused is that children's understanding of decimal numbers is quite inadequate. This is why research into children understanding is the key to teachers' knowing how children are likely to interpret what they say.

Roles of mathematics teachers for scientific and economic development

Why do students have drastic change in their attitudes toward mathematics? This has been a lingering question to the teaching and learning

of mathematics from time immemorial. One possible explanation is that as students grow, they become more aware of their instructors' interest and enthusiasm for teaching mathematics. They seem less motivated to learn when they feel that instructor is not happy in teaching and does not enjoy being with them in the classroom (Jackson & Leffingwell, 1999). Instructors who care about students must realize that making a positive environment in which to teach and learn mathematics may reduce performance's anxiety and encourage enjoyment in mathematics (Furner & Berman, 2003). Another possible explanation for the change in student attitudes toward mathematics would be the nature of the classroom. College and university courses tend to be taught mostly by lecture method rather than through the use of activities that encourage student participation. A change in pedagogy is needed to improve student attitudes toward mathematics. Changes at the college level are necessary to increase student's interest in mathematics. If students have good attitudes about learning mathematics, they seem to understand the concepts which help them developing confidence in their ability to work on mathematical operations (Furner & Berman, Op cit). Teachers at the college level could promote a positive learning environment in the classroom by helping students develop the belief that mathematics makes sense and showing them that students could succeed at working in mathematics [National Research Council [NRC], 2001). The findings commonly described as negatively affecting students' attitudes are teacher behaviors, an emphasis on correct procedures and answers, difficult content, testing, a lack of comprehension, perceived irrelevance of content, family attitudes, and peer attitudes (Ellsworth & Buss, 2000). More research on standards-based pedagogy at the college level could increase instructor awareness about the effectiveness of the use of activities on student attitudes toward mathematics. ignificant contributions on this question are represented in national and state fforts to develop standards to guide reform among the identified roles of athematics teachers towards development. Teachers in schools face allenges in implementing the numerous standards and recommendations for athematics in the contemporary. Many teachers reading the National Council f Teachers of Mathematics' (NCTM's) Curriculum and Evaluation Standards for chool Mathematics (1989) and Professional Standards for Teaching lathematics (1991) must have got excited about the possibilities for new kinds instruction just as they are also bogged down by the overwhelming pectations about how they should provide the instruction. Within the mplex description of these two volumes provide about what teachers should and how they should act, with some basic metaphors that emerge about acher roles. Some of these roles may be fairly comfortable to and others may mind one of how hard it is to live up to expectation of an ideal teacher.

Teachers as architects who create the environment in which one lives and rk-both the buildings and the feelings they evoke. Similarly, the teacher as

architect creates the learning environment for students. Starting from the arrangement of furniture that facilitates discussion, thought and exploration, to the feeling students experience when they walk into the classroom, the teacher establishes an atmosphere where mathematics and learning are important. Most of all, the teacher creates a place where students feel safe to take risks and share ideas, while learning to value the opinions of each other. Apart from this, teacher as composer creates a musical score for performance by musicians, and by close reference teacher creates the tasks in which students engage. Within the rich environment created by the teacher as architect, the teacher as composer designs or selects something for students to do and that engage their intellect, stretch their thinking, increase their mathematical understanding, and expand their look of how to solve problems in their real world. Furthermore, teacher as movie director creates the learning environment and develops the tasks on which students spend their time. As movie director steps in to determine how the actors relate to each other, their tasks, and their environment the idea of discourse includes questions like: How will students interact with each other as they go through an activity? What teacher does or says with students? What questions from the teacher pushes student's thinking just a little farther? What kinds of communication really help a student develop mathematical understanding? These elements of discourse provide a foundation for student's reflection and communication that lead to the power of making generalizations and reasoning mathematically.

Also, teacher as stockbroker constantly analyzes the stock market, but in the case of the teacher as stockbroker constantly analyzes the teaching and learning that occur within the classroom. What worked today and what did not work? What will teacher does differently next time? What is worth the precious investment of students' time tomorrow? Similarly, teachers as ship captains of large ships have set a course, they cannot afford to sit back and wait until they either arrive at their destination or crash on the rocks. Ship captains must constantly be alerted to shifts in weather, ship traffic, and coastlines and they must be prepared for unexpected disasters. Teacher as ship captain deals with even more unpredictable factors than nature and commerce and must constantly be evaluating how and what students are learning. One cannot afford to wait until a student crashes on the rocks before noticing a pupil has veered off course. Rather, teacher must work closely enough with students so that student is providing ongoing course correction whenever misunderstandings begin. The teacher as ship captain may not always correct the student directly or immediately, but rather, the teacher makes a decision about what kind of experience could help the student to get back on course in a meaningful and timely way. By NCTM's standards teachers are described as mayor in the classroom, where students are actively involved in creating their learning experience. This learning community needs the strength of a knowledgeable and compassionate leader who considers the needs and talents

of the students, while providing a vision of where the community is headed and support for getting there. Giving students' responsibility for their own learning means giving up some control and creating a new kind of classroom leadership that truly guides, encourages, and enlightens along the way.

More so, teacher as red jacket serves the role of the person wearing a red jacket who greets the weary, confused and distracted traveler to assist in making connections. Teacher helps students experience the rich connections between the threads of mathematics like algebra, probability, measurement and geometry. As red jacket teacher helps student see the connections between mathematics and science, social studies, physical education and the arts. And most of all helps students make the vital connection between mathematics and the world outside of school. At any point one feels that one has learnt everything in this world precipitate learning of nothing at all, and this makes one to see teacher as student as well. Nowhere is a commitment to lifelong learning more important than in teaching. Even if every teacher today were completely knowledgeable about teaching standards-based mathematics, using current technology, and understanding new fields of mathematics, within six months or a year or two years, there would be a new need for professional development. Today's teacher cannot afford to remain static for more than a short time when the world is in a state of dynamic flux as every daily activity witness changes in technology, mathematics, schools, students, and society. In this setting, the teacher as student makes a lifelong commitment to professional development. In another dimension, teachers are recruiters as in most cases mathematics teachers have traditionally done a good job of encouraging students to pursue mathematics-related fields. Encouraging students to become mathematics teachers, however, has often been something one is reluctant to do, especially for the favorite students. One sometimes communicate teaching is not as worthy as profession as other more lucrative options. If teaching is not a career worthy of our future adults, it is the responsibility of professional educators to transform it into something that is worthy of future pride. The responsibility of the teacher as recruiter is to communicate not only to students but to the broader community on how important and rewarding the profession could be. The ideal teacher as recruiter is reflected in an experience shared by Kathleen, a teacher who recently received a Presidential Award. As she stepped down from the platform after her statewide award ceremony, she felt a tap on her shoulder and turned to see her former high school mathematics teacher. Kathleen shared with her former teacher that she was the inspiration for Kathleen choosing a career in teaching. As they were hugging, Kathleen felt a tap on her other shoulder. She turned to see a former student who told Kathleen that Kathleen was her inspiration for becoming a teacher. One could hope that the torch continue to be passed from generation to generation so that some of our finest minds

continue to prepare new generations of students who think and learn mathematically.

Finally, teacher as prospector refers to the bottom line of teaching. Here teacher picture the scene as if one is in a cave, dark, damp, musty, and cold but surrounded by solid rock, with nothing but a dim bulb on ones helmet and pick axe in ones hand. In the face of this bleakness, one keeps chipping away and chipping away and chipping away, because one knows that somewhere deep inside that solid rock are some incredible uncut gems and some well disguised nuggets of high-grade ores. That is why one called a prospector becomes a teacher.

In summary, mathematics teachers are saddled with the responsibility of ensuring that mathematics as a subject plays a vital role in the economy and scientific development of any nation, Nigeria inclusive, and this cannot be over-emphasized, as their roles are clearly stated above. At this juncture, mathematics teachers should note that they must not throw-in the towel and must keep applying teaching strategies in their classrooms even when new expectations seem unattainable.

Discussion of salient issues in the paper

Mathematics, as corroborated by Ilori (1994), is an instrumental tool which societies and governments around the world place premium importance on its teaching and learning for 'national development'. The fabric of society has become more and more underpinned by mathematical ideas. As a result, a major development in mathematics education in this millennium is synonymous to an increased amount of mathematics that all citizens are expected to know. Technological leaders and political leaders need mathematics education that takes into account both the new uses of mathematics and technology and new ways in which mathematics is fused into information technology. Wherever a person belongs in a society, he utilizes knowledge of mathematics in one form or the other not to speak of a president of a nation, an engineer, a businessman, an industrialist, a banker and a financer, a planner or a boss in a parastatal, even a labourer who has to calculate his wages, make purchases from the market and adjust the expenditure to his income. Whosoever earns and spends uses mathematics. Counting, notation, addition, subtraction, multiplication, division, weighing, measuring, selling, buying and many more are simple and fundamental processes of mathematics which require immense practice. The knowledge and skills in these processes provide in an effective and systematic manner only by teaching mathematics in schools (Kulbir, 2006). Despite its utility, mathematics has been one of the subjects which Nigerian students especially at secondary schools level develop dislike for and likewise perform poorly (Odili, 2006). To this end the re-branding process in Nigeria which was launched by late president Umaru Musa Yar'adua on March 17, 2008, was directed towards positive perception of Nigeria at home and abroad. Re-branding Nigeria is a

philosophical approach that compels a change in the negative perception of Nigeria's image at home and abroad (Salisu, 2009). The big question is, "what can be done to improve the teaching and learning of mathematics being a tool for self-reliance in Nigerian Secondary School system in order to re-brand Nigeria as a society? Kolawole and Oluwatayo (2004) stated that the more knowledge of mathematical concepts with the corresponding knowledge of their application to real life seems to be deteriorating. To develop scientifically, technologically, economically, politically depends on the manpower the country has acquired though it may sound unreasonable and unbelievable; studies have shown however that rapid national development could be achieved through application of mathematics on the national economy. Infact, statistics have shown that mathematics is closely knitted and has a key role to play in areas like leadership, economics and finance; management; business and enterprise; information technology; sports; brand export; entertainment; services and agriculture and natural resources. This was also corroborated in Encarta English dictionary which defined mathematics as a study of relationships using numbers, the study of the relationships among numbers, shapes, and quantities. It uses signs, symbols, and proofs and includes arithmetic, algebra, calculus, geometry, and trigonometry. By extention, mathematics could be used in finding answers to questions and problems of everyday life. Mathematics is applied in every facet of life including the general economy of the nation. For intance, Indian statesman and first prime minister from 1947 to 1964, Jawaharlal Nehru, understood the importance of mathematics in national development, said mathematics, as replicated in science and technology, was key to national development. He said: "Science and Technology capabilities represent the major difference in the developed and the developing world." For him, "It was science alone that could solve the problems of hunger and poverty, of insanitation and literacy, of superstition and deadening custom and vast resources running to waste, of rich country inhabited by starving people."

The Nigerian government, having discovered the important role of mathematics and science in national development, lent credendence through the Minister of Education, Prof. Ruquayyatu Ahmed Rufai to demystify mathematics through innovative teaching at a national workshop to mark the 2012 mathematical year themed *Key to national transformation: The role of local governments*. Among others the education minister said that mathematics education has been identified as critical to Nigeria's transformation agenda and national development. She said reiterated further that : "In the spirit of the transformation agenda of the Jonathan administration, the federal government has expressed in no uncertain terms its determination to nurture Nigerian youth capable of taking their destiny in their own hands through world-class education especially, mathematics and science education at school level." Enumerating other efforts at promoting

mathematics by the government, Rufai said that the President has organized friendly and healthy competitions such as the forthcoming Nigeria Mathematics Queen competitions nationwide. "This was aimed at enriching the knowledge of our pupils and students and also to serve as a motivation for many young scholars on the importance of mathematics and, in fact, science in the development of the nation," she added.

Speaking at the mathematical workshop, Rufai disclosed that different projects had been lined up to commemorate the 2012 Nigeria mathematical year. "All of which had been carefully designed to motivate excellence in mathematical sciences, promote new areas of application, increase the impact of mathematical sciences in our drive to attain global competitiveness of our productive functions and optimization of resource capacity in the science and technology sector. They are designed to remove phobia among students for the subject, popularize mathematics for national development and increase the interest for science and technology," she elucidated. The education helmsman further called on local government chieftains, who are the guardian of the grass roots, to promote mathematics education at their individual local level, charged them with the responsibility of encouraging and supporting activities leading to the improvement in the teaching and learning of mathematical sciences with the object of widening the scope of its application as a driving force for technological development of the nation. "The workshop not only provide opportunities for the local government chieftains to evaluate the potential input of mathematics to Nigeria Vision 20:2020, it proffered solutions that remove barriers and bottlenecks hindering the teaching and learning of mathematics at the local government level, and at the same time enhance collective capabilities for a greater Nigeria," she stated. She stressed that observing the 2012 Mathematical Year by Nigeria shows a high level of commitment to the scientific and technological empowerment of citizens to conquer ignorance, diseases, poverty and squalor, noted that the government's commitment to mathematical sciences invariably enhance the capacity of citizens to contribute to national development and increase productivity of the GNDP.

Earlier in his remarks, the Director-General (DG), National Mathematical Centre, Prof. Sam Ale said that Mathematics and science are the bedrock of the social and technological development of any nation. Citing the acivities of the centre among others, Ale said that the centre has embarked on various innovative projects to remove the phobia among students in mathematics by demystifying the application of the subject. He said: "We have written books at the local government level, you know that the local governments are in charge of primary schools. We intend to present this book to them during the three-day national mathematics conference so that there would be improved performance at the grass roots and the local government levels." He reiterated the centre committmet on a special computer initiative programme to boost

the teaching and learning of mathematics. "The programme, according to him, will be carried out under a contributory scheme where laptops be distributed at a very subsidized rate, with government pay part and the beneficiaries complete the amount. This is embarked-on because of the opportunities ICT has to offer, say for instance a child could use IPAD to learn mathematics, and this is because a lot of mathematics programme has been programmed into it. This we believe could boost the teaching and learning of mathematics," he stated.

Implication of the salient issues

The following steps may provide impetus for education of those areas of mathematics which have great potential for economic and scientific development of a nation.

(i) Creating facilities for training existing faculty members in Nigerian higher institutions to impart instruction in areas of mathematics and mathematics education in order to promote those branches of mathematics that are more relevant to economic and scientific development.

(ii) Talents and financial resources of countries like Nigeria, South Africa, Ghana and other leading Africa countries should be pooled together to promote teaching and research of those branches of mathematics education and mathematics that are more relevant to economic and scientific development .

(iii) Active interaction of higher institutions in Nigeria with organization such as WAEC, NECO, and NERC must be established.

(iv) New mathematics courses should be introduced and incorporating mathematics education, and those branches of mathematics that are more relevant to economic and scientific development of Nigeria with application oriented approach.

(v) Active collaboration, in the research fields in mathematics education and of those branches of mathematics that are more relevant to economic and scientific development between Nigeria higher institutions and other countries higher institutions must be encouraged both at individual and institution level.

Recommendations of the salient issues

Teaching and learning of mathematics for life skills and self reliance implies making the learners see mathematics beyond the classroom boundaries. It means that learners must be brought to the real world of issues and relate the mathematics they learned to the realities of life. The essence of teaching and learning mathematics for self-reliance is to promote responsible citizens as a sure way in the re-branding process.

Based on this research work, the following recommendations are made:

(1) Mathematics teachers should endeavour to relate mathematics concepts to real life situations.

(2) Government should employ more mathematics teachers and supply adequate instructional materials and equip mathematics laboratory for effective teaching and learning of mathematics in Nigerian secondary schools.

(3) Mathematics curriculum planners should ensure that, there is proper integration of the curriculum in all secondary schools in Nigeria.

Critical overview and suggestions

This paper reviewed the nature, place and role of mathematics and teachers in the Nigerian educational system. It looked at the nature of mathematics for 21st century economy in Nigeria and submitted that mathematics has a great role to play in sustaining her national development. It is therefore very important and should be treated as a matter of urgency that efforts must be made by stake holders to put mathematics education on a sound footing in the Nigeria educational system in order to propel the nation for a dynamic economy and national development in line with vision 2020. There is no doubt that there would be improvement in the quality of life of both the teachers and learners of mathematics if all the recommendations above are strictly adhered to.

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