Reforms in secondary schools mathematics curricula in Nigeria: a need for human resource development for global competitiveness

Felicia U. Chinweoke
COOU – Chukwuemeka Odumegwu Ojukwu University
Anambra State, Nigeria
fchinweoke@gmail.com

Abstract. This paper is centered on reforms in secondary schools mathematics curricula in Nigeria: A need for human resource development for global competitiveness. Great effort was made in discussing the challenging need for the reforms which include the inability of the old curriculum to meet the need and aspirations of the present society. The need for human resource development and the areas of need for human resource development were discussed under teachers' teaching methodology, knowledge of the subject matter; teachers' resourcefulness etc. The implications of human resource development for global competitiveness were also discussed. Recommendations and educational importance were stated. One of the importances is that the paper may be of use to educational organizations like Science Teachers' Association (STAN) International Council of Association for Science Education (ICASE) and other professional bodies of education, in selecting and organizing the themes of their workshops and conferences.

Keywords: reforms, mathematics curriculum, human resource development, global competitiveness.

INTRODUCTION

Mathematics as a discipline is one of the subjects needed for realization of scientific and technological advancement of our country. Mathematics is the bedrock of all sciences. Mathematics is also the backbone of technological breakthrough (Awofala, 2012). The importance of mathematics in the scientific, technological and economic development of any nation has made its teaching and learning in secondary school very important. Yar'Adua as reported by Edukugha (2009) said that mathematics and science education are the only ways the federal and state ministries of education and other agencies can achieve the millennium development goals within the time frame. She also said that the very existence of any area of human endeavour is based on mathematics and mathematical sciences, and recently ICT, itself a product of mathematics, has taken over the global stage. The importance of mathematics in connection with the technological development and the need for globalization necessitated the reform in secondary school mathematics curriculum.

Reform in curriculum simply means changes made in introducing new concepts/topics considered to be useful in meeting the needs and aspiration of the people. The reforms in secondary school curriculum saw the inclusion of modular arithmetic, logical reasoning, matrices, and calculus into the mathematics curriculum and ICT, Civil education, HIV/AIDS, entrepreneurial subjects into the school curricula in general. The reform was approved by the National Curricula on Education for national implementation in 2008.

THE CHALLENGING NEEDS FOR THE REFORMS

The motives for the reforms according to Awofala (2012) are to meet the need for Universal Basic Education, to promote ideal of National Economic Empowerment and Development Strategy (NEEDS), to achieve Education for all (EDA) and Millennium Development goals (MDGs), the need to produce better informed Information and Communication Technology (ICT) compliant, bilingual citizens of high ethical standard, overcome problems with the previous curricula and also keeping pace with emergent global and national issues. Basic education programme was introduced in 1999 by the Federal Government of Nigeria as a reform programme aimed at providing greater access to and ensuring quality basic education throughout the country. Federal Republic of Nigeria (2004) stated that Basic Education shall be of 9-year duration comprising 6 years of primary education and 3 years junior secondary education which should be free, universal and compulsory and teaching shall be practical, exploratory and experimental methods.

Awofala (2012) pointed out that Nigeria as a signatory to the United Nations prepares to achieve the MDGs by 2015 through a functional basic education and in 2004 derived a home

grown economic blue print known as the national Economic Empowerment and Development Strategy (NEEDs) to generate wealth, create employment, eradicate poverty and engage in meaningful planning in education.

The moribund of the old curriculum also necessitated the reform. The old curricula ceased to be functional as it is not ICT compliant. According to Awofala, mentioned earlier, educating the mind is developing the nation and it is only through a functional and responsive curriculum that the minds can be cultivated for a meaningful development and contribution to nationhood. The need to adopt to process evaluation and use of alternative assessment tools motivates the reform in the curriculum. The emphasize was also made in the new processes of learning and the development of generic skills and the need to teach mathematics with students centered strategies rather than old transitional method.

The new curricula emphasized constructivist approach to teaching and learning which involves active learning, use of manipulative, skills cooperative learning, use of realistic and genuine tasks are emphasized in place of old traditional method of teaching. Through active learning, teachers create opportunities for students to engage in new materials serving as guides to help them understand and apply information.

The old curriculum also failed to meet with the emergent global and national issues like Information and Communication Technology and other issues. The need to produce better informed, ICT compliant, and globally competitive bilingual citizens of high ethical standard requires that quality education in the area of ICT, core national values and civic responsibilities be provided and curriculum remains the only tool to achieving this. Most curricula failed at the implementation stage when teachers are not adequately prepared to take up the challenges in the new curriculum (Nwosu & Mkpa, 2008; Awofala, 2012).Most people (Okebukola, 2002; Betiku, 2002) pointed accusing fingers to teachers as the major factor responsible for students under achievement in mathematics/sciences. This is because the effectiveness of teaching learning in the classroom depends on teachers' knowledge of the subject matter, teachers' teaching methods/strategies, and resourcefulness of teachers, teachers' creativity and competencies in teaching in the classrooms. So, for this new curricula in secondary school to be successfully implemented and sustained, secondary school mathematics teachers need to undergo successful human resource development. Ajewole (2005) pointed out that the quality of any educational programme in any country is the function of those who teach it. Therefore teachers who are to take up this new curriculum should be intellectually and professionally trained to adapt to the challenges in the new curriculum contents by undergoing human resource development.

WHY THE NEED FOR HUMAN RESOURCE DEVELOPMENT

Wikipedia (2006) defined human resource development as the process of equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively. The wealth and vitality of a nation rest ultimately upon the development of their human resources and upon the effective commitment of human energies and talents. Development means the enlargement of personal potentials through the acquisition of beliefs, values, skills and knowledge (Agbowuro & Oriade, 2006). Human resource development is the training and the educating of workforce to improve their knowledge, skills, potentials, creativities, competencies and resourcefulness in their job. Human resource (teacher) development ensures that the teaching force is continually upgraded to meet the new challenges and reforms in education as in mathematics education and its curriculum. Mathematics teachers were found to be responsible for students' poor performance in mathematics due t teachers' teaching incompetencies, inadequate knowledge of the subject matter, lack of skills for Improvisation of resource materials among others (Chinweoke, 2008; National Teachers' Institute, Kaduna.2007;Okebukla,2002). Adenegan (2014) also stated that mathematics teachers were also responsible for students' phobia for mathematics due to their poor teaching methodology. The attainment of qualitative education depends largely on the quality of teachers and their devotion to duties. There is no doubt that poor quality of human resources (teachers) may reflect negative attitudes toward mathematics education in schools and their products.

The reforms in school mathematics curriculum call for the need for the development of teachers for effective implementation of the curriculum in the classrooms. Salman (2006) pointed out that in order to help the children to be intellectually informed in mathematics ideas, methods and skills for logical reasoning and scientific enquiry requires well groomed and qualified professional teachers of mathematics. Mathematics teachers need to undergo teacher development in the area of knowledge of the new concepts introduced in the curriculum, teaching methods/strategies for teaching the concepts, resourcefulness in creating and improvising resource materials and the use of information and communication technology in teaching and learning mathematics. The effectiveness of the curriculum implementation lies on human resource development. This is because the extent to which teachers are

development determines the effectiveness to which the aims and objectives of the curriculum is achieved. Abba & Ubandoma (2006) opined that human resource development is much more than providing intellectual ability through formal education system, it involves self-development by further learning and training, research, teaching etc. Thus human resource development can be achieved by training and retraining of mathematics teachers to equip them with the new trends in mathematics curriculum. Eze & Eze (2013) saw training as the process of developing a natural ability or quality in an individual so that he/she improves. Training sharpens in-born abilities, skills and potentials in an individual thus making that individual functional and productive in the society. Training also enhances efficiency of teachers by equipping them with essential work habits, competencies, creativities and initiatives needed for improvement in teaching and learning, hence influencing classroom productivity.

Mathematics teachers need to undergo human resource development due to issue of obsolescence. Teachers due to long stay without refresher course might be out dated in knowledge and competences, in such case they need to undergo refresher courses to update them. Oteh (2008) emphasized that all categories of servicing teachers (mathematics teachers in particular) need in-service education to continuously upgrade their knowledge and skills, in order to remain current and relevant in the system. Nwagwu (1998) maintained that those with professional training require such programmes like in-service training to acquaint themselves with the latest knowledge on their subject area of specialization, research findings on students and their behaviour development and learning processes.

AREAS OF NEED FOR HUMAN RESOURCE DEVELOPMENT

Knowledge of the subject matter

Mathematics teachers being the chief implementers of the curriculum in the classroom need to be authority in the subject area they teach. Now that new concepts/topics have been introduced into the school curriculum, mathematics teachers need to be conversant with those topics in order to impart it well to students. Akpan (1998) posited that the major provision for teacher education in the national policy in education is the prescription that all teachers in our educational institutions should be professionally trained. The provision was made with a view that teachers after training will be authority in the subject area they teach. So, mathematics teachers need to be retrained in the knowledge of the subject matter to be professionals in teaching them. Ikediugwu (2002) stated that teachers cannot teach beyond the knowledge of their students or give their students what they did not possess. When teachers are properly equipped with the knowledge of the subject matter, classroom teaching/learning tend to be effective and thus increase students' performance.

Teachers' teaching competencies

Mathematics teachers need to be well developed in the area of their teaching/learning competencies so as to enhance their classroom performances and their students' mathematics achievement, Teachers need to be highly competent in their pedagogical content knowledge. Obi (2003) opined that an incompetent teacher because he/she cannot deliver effectively, his/her lessons tend to be non-motivational and un-interesting to student and so the students achieve poorly at the end. While the competent teacher is efficient and effective and will always exhibit acceptable organizational behavior and hence arrest students' interest and attention which in turn enhances students' performance in the subject he/she teaches.

Creativity of teachers in teaching/learning of mathematics in the classroom

Mumford (2013) defined creativity as the tendency to generate ideas that may be useful in solving problems. Ibifiri (2014) pointed out that creativity is all about originality, imagination, inspiration, ingenuity, inventiveness, resourcefulness and vision. Ugwuda & Odo (2014) posited that creativity is a combination of critical thinking and innovations. Mathematics teachers need to undergo training through self-development and education for all these attributes of creativity to be fully developed in them. These attributes are highly needed to be present in the mathematics teachers for them to implement the new curriculum effectively in the classroom.

Methods and strategies in teaching/learning mathematics in the classroom

Kolawole (2005) emphasized that while it is necessary to be knowledgeable about a particular concept, it is also necessary to know how to impact it adequately to the students. The new reforms in mathematics curriculum also emphasized that teaching should be student-centered. Student-centered teaching strategies takes into account the constructivist pedagogies such as

activity-based learning use of manipulative skills, cooperative learning and use of realistic and genuine tasks at the expense of traditional methods of teaching. Through activity-based learning, teachers create opportunities for students to engage new materials, serving as guides to help them understand and apply information (Awofala, 2012). So, mathematics teachers need to undergo training to acquire these new teaching methods in imparting the new concepts to students to enhance students' performance in mathematics.

Teachers' resourcefulness

Mathematics teachers need to undergo adequate training in the area of resourcefulness in sourcing instructional materials in teaching the newly introduced concepts. Most of these concepts need the use of resource materials in teaching them for students understanding. The concepts like matrices, calculus and modular arithmetic need that instructional materials are used in teaching them in order to make them clear and understandable to students. In such case teachers need to be trained and developed adequately on how to source the resource materials through improvisation to help students learn mathematics. Okeke (2009) pointed out that improvised instructional materials used in teaching students enhance meaningful learning and students' mathematical performance.

Effective use of information, communication and technology (ICT) in teaching/learning of mathematics

Okolo (2005) emphasized that the information and communication technology (ICT) is revolutionizing all aspects of human life and life style. The age of computer technology with its solution to the human problems of communication and information management science, has its rudimentary genesis in mathematics. He maintained that mathematics teachers and students can use the internet both to access materials and resources and to display their web pages created by the teacher and students. This enhances teachers role as a manager of the learning process rather than of the content and this helps students to learn more productively. Apart from this, the use of computer helps mathematics teachers in analysis, assessment and evaluation of students result in the Microsoft excel. Teaching and learning of mathematics with the use of computer may go a long way in enhancing students' academic performance now that external examination bodies like JAMB, WAEC are now making use of ICT in examination and evaluation of students instead the old paper and pencil test examination. Hence mathematics teachers need to undergo serious human resource development in the use of ICT in teaching/learning mathematics in the classrooms.

IMPLICATIONS FOR GLOBAL COMPETITIVENESS

Mathematics education and developing programs and their activities should focus on development of human potentials and productive work force necessary for global competitiveness. Ojo (2009) pointed out that human capital development is crucial and central to any meaningful national growth and development as well as necessary and important for global economic competitiveness. Global competitiveness is the ability of a nation to give products and offer services that can stand out to win the price for quality standards in the international or world competition and thus providing adequate feed backs on the resources employed in producing them. Nigerian quest to be one of the 20 most industrialized nation by the year 2020 can only be achieved if Nigerians increase their productivity through development of mathematics teachers.

Productivity is a major determining factor in the improvement of national economic growth and development; no nation can be self-sufficient without becoming more efficient and more productive in all sectors of the economy (Utayi, 2009). The realization of vision 20-2020 depends on the extent to which the human capacity is developed and transformed to compete globally (Jimoh, 2009). The reforms in mathematics curriculum were initiated so that if adequately implemented in the classroom will produce educated and global competitive self-reliant citizens. Ezeokoye (2005) posited that an important influence on productivity is the quality of the workforce and a major investment necessary to productivity is training. In order to meet up with global competitiveness and new challenges, even the best educated employees need to increase and adopt their knowledge and skills in their job performance. Mathematics teachers in turn need to acquire and develop new knowledge and skills meant for efficient performance of their duties. The quality of human resource development (mathematics teachers) produced determines the teachers' classroom productivity as quality teachers always make effort to produce quality students, who in turn through their performances and achievements will attain global competiveness.

CONCLUSION/RECOMMENDATIONS

The reforms in mathematics curriculum were necessitated by the nation's aspiration to meet up with new emergent issues needed for national development which the old curriculum failed to offer. Nigerian's dream to be among the first twenty (20) developed country in the whole world and achieve Millennium Development Goals in the year 2020, need that their human resource development should be taken seriously especially in the area of mathematics education. The importance of mathematics and mathematics education in the area of scientific and technological development cannot be emphasized. The record shows that economic management remains challenged by weak implementation capacity (African center for Economic Transformation, 2014). So, great effort was made to identify the challenging need for the reforms in mathematics curriculum to be as a result of the moribund nature of the old curriculum in meeting the needs and aspirations of the society. The reasons for the need for human resource development was identified along with the areas of need for human resource development which include knowledge of the subject matter, teachers teaching competencies creativity of teachers, methods and strategies in teaching and learning, teachers resourcefulness, and effective use of ICT in teaching/learning. If Nigeria is to be successful in mathematics curriculum reforms and attain global competitiveness in mathematics education, teachers should undergo human resource development. In order to ensure the success and effective implementation of the new curriculum, the following recommendations are made;

1. All educational stake holders in Nigeria both ministries of education and state education commission supervisory principals should monitor and continuously supervise the implementation of the curricula in the classrooms and their products in order to identify the weaknesses and strengths of the curricula and to beef-up any loop-holes.
2. There should be proper planning towards successful implementation of the new secondary school mathematics curriculum. Mathematics teachers should be trained and retrained by sending them to in-service training by the federal and state government by giving teachers grant to go on self and students' development.
3. Facilities, equipment and teaching/learning resources should be provided.
4. Adequate funding should be provided by federal and state governments to meet up with the challenges the new curriculum.

EDUCATIONAL IMPORTANCE

1. This paper may be of great help to educational organizations like Science Teachers' Association of Nigeria {STAN}, International Council of Association for Science Education {ICASE}, and others, in selecting and organizing their workshop and conference themes.
2. The paper also may be helpful to the government {both federal and state} in funding of education.
3. Teachers may also be lucky to benefit from educational trust fund to attend human resource development.

References

Abba, I. & Ubandoma, Y. (2006). Human resource development model for integrated science (HUDMIS).In Uche Nzewi (ed.), *Proceedings of 47th Annual Conference of STAN*, 227.

Adenega, K.E. (2014). Popularizing the mathematical science through the mass media reportage. *Journal of Issues on Mathematics, 16, (11).* The annual publication of mathematics panel of STAN, 1-10.

African Center for Economic Transformation (2014). *Nigeria transformation profile*http://africantransformation.org /2014/02/07/Nigeria/, retrieved 12/3/2014 2:33pm.

Agbowuro, C. & Oriade L.T. (2006). Human resource development for the teaching of Biology practical. In Uche Nzewi (ed.), *47th Science Teachers Association of Nigeria Annual Conference Proceedings*, 116.

Ajewole, A.G. (2005). Science and technology in secondary schools. Need for manpower Development. In Uche Nzewi (ed.), *Journal of Science Teachers Association of Nigeria (JSTAN)* **40** (1&2), 63–67

Akpan, B.B. (1999). Competencies required of teachers in the 6-3-3-4 system of education for the secondary schools. *Perspectives on education and science teaching: From the eyes of Uduogie Ivowi* 125-132.

Awofala, A.O.A. (2012). An analysis of the New-9-year Basic Education mathematics curriculum in Nigeria. ACTA *DIDACTICA NAPOCENSIA*, 5(1) dpph.ubduj.ro/adn/article-5-1-3.Pdf, retrieved 12/3/2014, 2:33pm.

Betiku, O.F. (2002). Factors responsible for poor performance of students in school mathematics: Suggested remedies. In Matt. A. G. Akale (ed.), *Africa, Proceedings of the 43rd Annual Conference and Inaugural Conference of CASTME, STAN*

Chinweoke, F.U. (2008). Determination of competency needs of secondary school mathematics teachers in Anambra State. *Unpublished dissertation of Nnamdi Azikiwe University, Awka.*

Edukugha, E. (2009, June 12, Thursday). "Why F.G. support Cowbell secondary school Maths contest", *Vanguard Newspaper* 39.

Eze, C.U. &Eze, G.N. (2013).Enhancing human capital development of Science and technology teachers for effective teaching in secondary schools: Teachers perception. In O. Ebonyi (ed). *54th Annual Conference of Science Teachers Association of Nigeria*, 62-68.

Ezeokoye, B.N. (2005). Facilities/delivery system and evaluation by e-learning programme on basic telecommunication in Nigeria. *In Uche Nzewi (ed.), Journal of science teachers Associations of Nigeria (JSTAN),* 40 (1&2), 90-97.

Federal Republic of Nigeria (2004). *National Policy on Education 4th edition*, Yaba, Lagos-Nigeria NEDRC press, 13-15.

Ibifiri, B.P. (2014). Pico stem sheeps3 network-dimension of creativity: A panacea for educational challenges, poverty reduction and disease control in the 21st century. *55th Annual Conference of Science Teachers Association of Nigeria*, 25-35

Ikediugwu, N. (2002 Oct/Nov. 3).The expectations of Anambra State Education Commission from her teachers. *ANSSEC Mirror magazine*.

Jimoh, A. (2009, June 3, Wednesday) "Universities critical to attainment of vision 2020, Says Egwu" *Nation Newspaper*, 6.

Kolawole, E.B. (2005). Comparative analysis of the three methods of solving quadratic equations. *Abacus: The Journal of the Mathematical Association of Nigeria,30(1)* 78-85.

Mumford, M.D. (2003). Where have we been, where are going? Taking stock in creativity research. *Research Journal* 15, 107-120.

National Teachers' Institute, Kaduna (2007).*Manual for the re-training of primary school teachers, improvisation of resource materials.* A Millennium Development Goals {MDGs}

Nwagwu, N.A. (1998). "In-service teacher education programmes." *In N.A. Nwagwu (ed.), Teachers and teaching in Nigeria: Issues, challenges and prospects, Benin City, Festa Printing press Ltd.*

Nwosu, H.I.O. & Mkpa, N.D. (2008). Assessment of the problem and prospects of the 6-3-3-4 structure of Education in Abia State. *In T.N. Kannon (ed.), Current issues in Nigeria Education: A book of readings,* 186-196.

Obi, E. (2003).*Education management: Theory and practice JAMOE Enterprise, (Nig.)* 84–97.

Ojo, J. (2009 April 23, Thursday). "Declare state of emergency in education sector" *Thisday Newspaper* 14(5113), 19.

Okebukola, P. (2002). *Beyond the stereotype to new trajectories in science teaching*. Science Teachers Association of Nigeria (STAN), publication, 26.

Okeke, N.F. (2009). The effect of improvised instructional materials for the teaching and learning of mathematics: Implications for qualitative and functional education. *Journal of science Education, 10 (1) School of Science Nwafor Orizu Collage of Education Nsugbe, Nigeria,* 141-148.

Okolo, P.N, (2005). The role of information and communication technology in mathematics education. *Abacus: Journal of the mathematical Association of Nigeria (MAN),* 30 (1) 13

Oteh, J.E. (2008). Improving teacher competence through refresher courses. *In T.N. Kannon (ed.), Current issues in Nigeria Education: A book of reading,* 205-211.

Salman, M.F. (2006). Teachers as factor in the implementation of the Universal Basic Education (UBE) mathematics curricula. *Proceedings of September 2006 Annual National Conference of Mathematical Association of Nigeria (MAN),* 145

Ugwuda, A.O & Odo, J.A. (2014). Re-engineering science, technology, engineering and mathematics (STEM) education for creativity development in Nigeria. *55th Annual Conference of Science Teachers' Association of Nigeria (STAN),* 55-60.

Utayi, E. (2009 May 15, Friday). How Nigeria can achieve vision 2020, by Yar'Adua". *Nigerian Compass Newspaper,* 7.

Uzoechi, B.C., Ubah, A.I. & Kurumeh, M. S. (2013). Computer aided instruction: An essential tool for teaching and learning of mathematics in secondary schools. Proceedings of Science Teachers' Association of Nigeria 54th annual conference, 363-368.

Wasagu, M. A.(2009). Re-thinking science education for changing times: The writing on the wall. *Eight inaugural lecture of Usman Danfodiyo University, Sokoto, March 26.*

Wikipedia (2006). Capacity building at http://www.ansiness.com/capacity%20building.

Author

Dr. Felicia U. Chinweoke, departmental curriculum officer, department of science education, Chukwuemeka Odumegwu Ojukwu University, Anambra State, Nigeria.