

## ***Challenges facing Mathematics Education after the COVID-19 Pandemic Lockdown***

**<sup>1</sup>Umaru Salihu Momozoku, Ph.D**

[emozoku@yahoo.com](mailto:emozoku@yahoo.com)

**<sup>1</sup>Abdulmalik Onubedo Audu**

[aaonus@gmail.com](mailto:aaonus@gmail.com)

**<sup>1</sup>Olorunsola Oriola Niyi, Ph.D**

[niyisola@gmail.com](mailto:niyisola@gmail.com)

**<sup>1</sup>S. O. Alagbe**

[simeonolu2012@gmail.com](mailto:simeonolu2012@gmail.com)

<sup>1</sup>Department of Mathematics

School of Secondary Education (Science Programmes)

Federal College of Education, Kontagora, Niger State

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### **Abstract**

*Education is the key to sustainable development, growth and productivity the world over, which is acquired by learners through schooling. In recent years, 2020 specifically, schools were closed down partially or totally in some countries of the world including Nigeria due to outbreak of COVID-19 pandemic ravaging the world populace. This paper discusses the challenges facing Mathematics education after the lockdown of education system in Nigerian tertiary institutions. The paper focuses on the use of ICT in teaching and learning, teachers, pedagogy, curriculum, classroom, semester and funding. It recommended that the government should consider an upward review of the education budget to meet up with the 26% allocation recommended by UNESCO instead of less than 10% approved in 2021; government and other stakeholders in education should urgently invest and improve the structural facilities so that short-term setbacks do not grow into larger, long-lasting problems; and that government should improve teachers' digital competences across all ages through workshops, seminars and continuous professional development.*

**Keywords:** COVID-19, mathematics, ICT, curriculum, classroom, funding

### **Introduction**

Mathematics is an intellectually stimulating subject that affects every facet of human endeavour be it in politics, commerce, science and technology. The supremacy of Mathematics over other subjects is extolled by Federal Republic of Nigeria (FRN, 2004) when it stated that Mathematics should be made compulsory (core) subject in the primary and secondary education levels. Learning Mathematics aims at developing the total individual by fostering creativity, logical thinking, transfer of knowledge to real life situation, and enhancement of personal discovery. While the indispensability of mathematics in the development of a nation has been universally acknowledged, the

output of its teaching and learning is still not encouraging (Charles-Owaba & Abuge, 2020).

Many variables such as curriculum, teacher-student relationship, textbooks, lack of interest, large class size, lack of qualified teachers, psychological fear of the subject, and teaching methods had been identified as responsible for students' low academic performance in Mathematics (Charles-Owaba & Abuge, 2020; Bolaji, Kajuru, Ibrahim & Momozoku, 2020). However, in recent years, specifically year 2020, the emergence of COVID-19 pandemic has changed the mode of human interaction in the world. The pandemic affects education sector by forcing the cancellation of the traditional learning that takes place in school settings and giving opportunity for restructuring the present conventional classroom-based educational system. It imposes the use of alternative learning mode which is digital device. As such, to fit into the new demand hasten by the pandemic, Mathematics instruction adopts technology-mediated instruction by utilizing ICT in Mathematics education.

### **Challenges facing Mathematics Education**

i. Information and Communication Technology (ICT): Global education has tilted towards technology-mediated learning and it becomes imperative to key-in as quickly as possible. Technology encompasses computer and telecommunication used in handling, acquiring, processing, storing and dissemination of information. It is the application of digital equipment to all aspects of teaching and learning. It consists of hardware, software, networks and media for collection, storage, processing, transmission and presentation of information. Technology can be used in constructing knowledge and problem solving through the internet, e-mail, CD-ROMs, databases, videoconferencing, using process skills, aiding explanation of concepts, and communicating ideas (Sani & Momozoku, 2017; Boaler, 2016). The COVID-19 pandemic has hastened the immediate use of digital technology in all aspects of education. The technology assisted instruction can be done through instructional radio, television, computers including information and communication technology (ICT).

ICT in the classrooms have become a window of hope to the educational system. The index for ICT availability for the students to use at school is calculated as the sum of the following 10 items: Desktop computer, Portable laptop or notebook, Tablet computer (e.g. iPad, BlackBerry, Playbook), Internet connected school computers, Internet connection via wireless network, Storage space for school-related data, e.g. a folder for own documents, USB (memory) stick, e-book reader (e.g. Amazon Kindle), Data projector (e.g. for slide presentations) and interactive Whiteboard (e.g. Smartboard) (The Irish Times, 2020).

ICT has become a tool for teaching and learning in which communication dependence is high as it is characterized by student-student and teacher-student interactions. Lawal and Awofala (2020) have recommended the use of ICT in Mathematics education which is relatively new in the teaching and learning of Mathematics; and advised teachers to

explore the richness of blended learning, a combination of use of ICT and traditional classroom approaches, which has shown to yield a positive and statistically significant increase in students' Mathematics achievement. Ojaleye and Awofala (2018) believed that ICT materials could be better used as supplement to classroom-based courses and instructions. It is uncommon in Nigerian schools today possibly as a result of lack or the absence of any government policy on the provision of ICT facilities (Charles-Owaba & Abuge, 2020; Lawal & Awofala, 2020).

A few studies on teachers' use of ICT revealed that a higher portion of teachers are faced with the challenges of the slow speed of devices owing to viruses, insufficient number of computers, inadequate time for using e-resources, sluggish internet connectivity, power failure, inadequate skills/training on ICT tools/programme/services, shortage of ICT facilities/devices, teachers' lack of knowledge and skills, unreliable and inadequate power supply, and inadequate funding were identified as major problems constituting hindrance to the use of ICT in teaching and learning of Mathematics in Nigerian tertiary institutions (Khirwadkar et al., 2020; Fakir et al., 2015; Eze & Eze, 2013).

Lawal and Awofala (2020) reported that tertiary education students did not participate in online classes of any mode during the COVID-19 lockdown and after COVID-19, no tertiary institutions (public) is involved in the use of ICT for teaching and learning process. Quaye et al. (2015) observed that the frequency of ICT use in Mathematics education before, during and after lockdown is quite worrisome as a downturn was observed at a time when the rest of the world is deeply immersed in academic ICT activities for gainful study. There is need for a reflection and reappraisal of the existing structures to ensure that adequate provision and attention is given to the existing infrastructures in the colleges.

ii. Teacher: At the centre of any educational process is the human relationship between a student and a teacher. Throughout this crisis of COVID-19 pandemic, many societies have begun to acknowledge the importance of a set of workers who have not always been properly appreciated. This COVID-19 pandemic has recognized and appreciated how essential the labour of teachers is, particularly their professional expertise and commitment. Teachers need to be recognized more and valued more highly; they are essential participants in defining the future of education (UNESCO, 2021).

The interaction with teachers and students is found to be essential for the development of positive self-esteem, self-confidence, and a sense of identity. It also improves students' ability to work in groups in collaborative and productive ways. There is significant evidence showing that social skills are positively associated with cognitive skills and school achievement.

The role of the teacher is crucial and important in realizing the goal of mathematics education. The Federal Republic of Nigeria (FRN, 2004) stated that no education can rise above the quality of its teachers. Omokaro and Nwanunu (2020) view teachers' quality in

three domains including having the required body of knowledge in a particular field, attitude, and pedagogy and skills which will enable a teacher to impart his/her knowledge efficiently and effectively.

The difficulties teachers encountered in the new normal education include: additional workload, lack of time for planning and preparation, balancing diverse learning needs, handling too many students and size of the classrooms, internet and technology issues, lack of funding, worries that higher attaining students are being neglected, pressure to cover the syllabus, concerns with regards to pace of instruction, shift in evaluating students' learning, and students' attitudes and behaviours, among others (Manila, 2020; Chen, 2021). It takes a lot of courage to keep the classroom going. Teachers make serious efforts to tackle all these difficulties in the classroom and contribute their best to teaching worldwide before, during and after the COVID-19 pandemic.

iii. **Teaching Pedagogy:** Pedagogical methods of teaching concepts help students to enhance their recall capacity by recollecting all the ideas that were taught to them even after a long gap. In doing these, teachers need to overcome a lot of difficulties in the classroom (Omokaro & Nwanunu, 2020). Various studies have indicated that blending instructional practices could lead to better students' performance, perceptions, and attitudes toward the subject, and higher attendance rates (Boaler, 2016). Computer-based technologies have been successfully incorporated into traditional classes to complement face-to-face instruction. Hands-on, minds-on activities including class discussions and virtual pre-laboratories using computer simulated activities, among others are a regular feature of the classroom activities.

Education and learning are dynamic processes. Likewise, knowledge itself is not static. Knowledge changes according to changes in the wider society and according to the tools available to a given people. There is need to adjust pedagogical approaches to meet changes as they occur including students. There is therefore need to devise ways of keeping the knowledge not only relevant but also appealing to the generation of students served (Bolaji et al., 2020).

iv. **Curriculum:** It is a known fact that each student is different from one another. Problems arise when a specific curriculum is prescribed for all students. The pace of understanding a concept differs from child to child. Situation turns crucial when teachers are expected to apply a fixed curriculum to students with varying needs. What works for one student may not work for the other. Diversifying teaching methods, but keeping it simple is a right solution, but it is hard to execute. Teachers are expected to follow the curriculum. This led to a situation where teachers teach and students learn only what is prescribed in the curriculum.

The post-COVID-19 curriculum can seize the possibility of achieving a responsive, ethical, humane education; one which requires a humanistic and internationally aware re-conceptualization of curriculum (Pinar, 2019). According to Marope (2017), "this calls

for higher flexibility in curriculum development and for the need to leave space for curricula interpretation, contextualization and creativity at the micro level of teachers and classrooms”. This “new normal” curriculum is said to be more horizontal and less hierarchical and radically polycentric with problem-solving produced through social networks, NGOs, transnational organizations and think tanks (Pacheco, 2017).

v. **Classroom:** COVID-19 pandemic has brought about recent development that has necessitated how learning in the classroom should be conducted by observing social-distancing. The structure of existing school buildings may be inappropriate if one wants to maintain physical distancing across tertiary institutions in the country (Pacheco, 2020). This requires a change in both the quantity and quality of the teaching capacity, implying significant investments in terms of qualified teachers and appropriate teaching/learning materials. Tertiary education students are typically taught by different teachers and they often move from one part of the school to the other.

However, the nature of the classrooms and the large number of students to be admitted in the classrooms call for an urgent concern. Lack of enough classrooms lead to overcrowded learning environment. The overcrowded learning environment can be referred to as having more than the number of students required in the classroom at a given time of learning period, which is a serious problem. Class size can be described as an average number of students per class under the guidance of one teacher during a given period of instruction in a school (Nwoye et al., 2020). While some researchers believed that students learn better in large class size than in small class, some observed that students learn better in smaller class sizes than in the larger class.

Nigeria as a nation realizes the importance of appropriate class size in learning and has a policy that guides the ratio of teachers to students in the learning environment. According to the Federal Republic of Nigeria (FRN, 2004), the standard ratio of teachers to students for science programmes in colleges of education is 1:30; but it has been noticed that many schools do not obey this policy as a result of inadequate learning facilities.

vi. **Duration of a semester:** The duration of a semester for Science programmes, according to the Federal Republic of Nigeria (FRN, 2012) as stated in the National Commission for Colleges of Education (NCCE, 2012) minimum standard, is fifteen (15) weeks. Its implementation has faced a challenge as many colleges failed to observe the stipulated number of weeks per semester. The findings of Temaugee and Saidu (2019) showed that for the past three years, the number of teaching weeks has been less than 15weeks requirement by NCCE minimum standard for curriculum implementation framework in Nigerian colleges of education.

Pietro in Temaugee and Saidu (2019) stated that educators in schools that use an extended-time model operate a philosophy that more time enable them to broaden and deepen the curriculum, to address the learning needs of the individual students and to build in opportunities that enrich students’ educational experiences. The structure of the academic

calendar influences educational outcomes; but little attention has been paid to this especially at the tertiary institutions in Nigeria. According to Temaugee and Saidu (2019), short semesters have negative effect on the academic performance of students. Students with low learning pace tend to suffer in such academic programmes and are seen to be weak students whereas the major factor working against them is the short length of the semester. Balancing diverse learning needs of students in the classroom will be different. Teachers are expected to satisfy both slow learners and fast learners; and this will require a lot of creativity and demand more time for planning.

With the ravaging COVID-19 pandemic worldwide, more time were lost to both teaching and learning in tertiary institutions where semester length were drastically reduced from the expected fifteen week to a little above ten weeks. Less time spent in learning can lead to learning loss which may lead to programme repetition in school (Lavy, 2015). Therefore, there is need for both the teachers and the educational institutions to know how to allocate their time most efficiently to maximize high academic performance.

vii. **Funding:** Is the availability of money or resources for meeting the needs of a given project or programme. It is a system of apportioning available capital belonging to an organization for meeting a need. Funding refers to a form of financial support that is given for the achievement of a project (Nwafor et al., 2015). Money or resources needed to manage the affairs of the institutions may be raised from within or outside the country. However, it remains one of the scarce resources that are in short supply among most institutions. Based on this situation, institutions usually develop alternative means of securing adequate funds to manage their various activities. These funds can be generated either within or outside the school from both educational and non-educational services (Nwafor et al., 2015). Funds may come from the government, community participation, private sector, development partners, non-governmental organizations, donor agencies.

Funds which serve as the life-wire for the management and administration of the educational sector assist in providing the basic resources needed for teaching and learning both in terms of quality and quantity, need to be adequate. Underfunding in tertiary education negatively impact on both the schools and the students. Less funding means less quality education, professional development is restricted, infrastructural decay, low level of commitment among staff, low level of academic performance, low patronage of Nigerian schools, higher cost of education, educational services are scaled back, and cuts tend to target schools where poor masses' children attended (Premium Times, 2021; Matt, 2019; Nwafor et al., 2015). It is important to remember that education is a necessity for populace (students) and with continuous budget cuts for schools, the students are the ones that are really experiencing the negative consequences of such government actions.

A research on education spending found that when states invest in their public schools and create more equitable school finance system, it meant better outcomes for students, higher graduation rates, better quality education, higher work output and leads to better quality of life to the students. Nwafor et al. (2015) noted that adequate funding in

education leads to infrastructural development, employment of quality teachers, reduction in education cost, and increase in the level of patronage.

Education needs financial support to supply adequate and relevant infrastructures to facilitate the current new normal in the pursuit of knowledge whose demand now is the inclusion of ICT in the teaching and learning thereby putting more pressures on teachers, parents, government, students and stakeholders in education to spend more money in training, provision of essential gadgets and internet facilities, and so on. Educational reform needs to be a focus when it comes to how the government budgets its money and finances, because if the current situation is kept on course, the public school system will fail the students. Nigerian government budget to education has been low, and worst in 2021 with education having 6.3% (EduCaleb, 2020). The issue of funding is central in the implementation of Mathematics curriculum in tertiary institutions in Nigeria. Availability of funds will enable schools to meet their entire requirement for achieving quality, equity and efficiency in schooling. Presently, there is no clear funds for the running of Mathematics education programmes.

### **Conclusion**

Change in educational trends brought about by COVID-19 pandemic is one of the worst classroom challenges faced by teachers. COVID-19 has exposed the weakness in the Nigerian educational system and potentially reshapes the educational system. The demand now is the inclusion of ICT in the teaching and learning thereby putting more pressures on teachers, parents, government, students and stakeholders in education to spend more money in training, provisions of essential devices/equipment by guaranteeing access to internet and availability of computers, laptops, or tablets to institutions of learning. More importantly is the training of teachers in ICT skills, to ensure that they have the pedagogical skills to meet the needs of the students at their level and to implement the accelerated curricula and differentiated learning strategies likely to emerge within the specified period of study. Education needs financial support to build more classrooms, provision of uniform curriculum, teachers' training, digital devices/appliances, internet facilities, adequate power supply, and relevant infrastructures to facilitate the current new normal in the pursuit of knowledge.

### **Recommendations**

The following were recommended:

- i. The government should consider an upward review of the educational budget to meet up with the 26% allocation recommended by UNESCO instead of less than 10% approved in 2021.
- ii. Managers and administrators of tertiary education should explore other revenue outlets that will help to balance the financial and infrastructural needs of the institutions.
- iii. The focus of ICT Mathematics learning should be activity-based, with focus on the exploration of mathematical concepts and relationships, in addition to problem-solving.

- iv. Government should improve teachers' digital competences across all ages through workshops, seminars and continuous professional development.
- v. Stakeholders in education should design curriculum materials specifically for digital technology use.
- vi. Academic planners of the college should allocate a minimum of 15 weeks for teaching and learning.
- vii. Government and stakeholders in education should urgently invest and improve the infrastructural facilities so that short-term setbacks do not grow into larger, long-lasting problems.

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