

ACHIEVING QUALITY MATHEMATICS TEACHING AND LEARNING IN THE ERA OF COVID-19 PANDEMIC IN NIGERIA

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Abstract

The knowledge of mathematics (which may be visible or invisible) occupies a core position in developmental programme of any society. It is capable of producing effective and skilled human resources needed in any emergency only when there is quality. Qualitative mathematics teaching requires that mode of delivery is fully action-packed and focuses the learners at all levels of Nigerian system of education in order to give the nation the expected result. Thus, this paper examines possible ways of achieving quality mathematics teaching and learning for preparation for emergencies. The paper navigates the pathway to achieving mathematics learning among Nigerian students during emergencies, the place of mathematics during the pandemic, emergency of COVID-19 and its effect on education. It also considers some strategies for teaching mathematics during pandemic, ensuring standards in the quality mathematics teaching and learning, process of achieving quality mathematics teaching and learning, and obstacles to good quality of mathematics teaching and learning during pandemic. The paper concludes that the survival of any nation or society depends to a large extent on development and research but it is a function of the strength of mathematics learning. The paper then recommends, among others things, that the curriculum developers should always review and change mathematics curriculum from time to time as occasion demands and not wait until it is absolutely necessary before assessing it,

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Introduction

In every society, mathematics is often seen as a prerequisite for quality development, creation of wealth, a sure path to success and service to humanity. Ajao (2014) opined that mathematical knowledge is very necessary to all human existence because it is all about finding solution to problems. In a clear term, Mathematics can be described as the intellectual, systematic and strategic attempt to explain and control the natural world. It entails dynamic and determined interaction with the universe through search and verifications.

The nature of mathematics is unique because it helps to look into and do verification combined with transfer whereby deductive knowledge, skills, and principles are acquired, tested and transmitted into meaningful development which may be visible or invisible. According to Awofala, Lawal, Isiakpere, Arigbagbu and Fatade

(2020), Mathematics is regarded as an exactly sane school subject that is capable of playing a significant, passionate and psychosomatic function in ambiguous periods, providing students with dynamic trappings to fight terror and propaganda.

Emergency, on the other hand, is a serious, unexpected and often dangerous situation requiring immediate action, and this may be of different levels such as routine, minor, major and catastrophic. In each case, impacts to life and property are significantly enough to warrant an aggressive response, an extensive and prolonged recovery period from all concerned quarters. Pandemic is seen as an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people. Merriam-Webster Dictionary (2020) defines pandemic as an outbreak of a disease that occurs over a wide geographic area (such as countries or

continents) and typically affects a significant proportion of the population. Examples of this include the Spanish flu of 1918/19, Flu pandemic in 1957 and 1968, the H1N1 pandemic of 2009 and now COVID-19 pandemic.

COVID-19 is the name given by the World Health Organization (WHO) in February 11, 2020 for the disease caused by the novel corona virus SARS-COV2. Corona virus disease 2019 is a contagious disease caused by severe acute respiratory syndrome corona virus 2. The first case was identified in Wuhan, China and has since spread worldwide leading to an ongoing pandemic. The virus that causes COVID is mainly transmitted through droplet generated when an infected person coughs, sneezes or exhales.

The reality on ground worldwide is that there is a problem which requires urgent solution or attention. Also, there is no single activity in which human beings can engage themselves, either individually or collectively, that will not involve mathematics. All the information put across via the multimedia approach about COVID-19 to alert the public of its deadliness, its contagiousness or how it spreads and can be prevented are mostly done numerically for easy interpretation and understanding. For instance, the table below shows the number of total confirmed, discharged and death as at 6th April, 2021.



Source: Nigeria Centre for Disease Control

The foregoing thus imposes and impresses it upon concerned stakeholders in Nigeria to give consideration to productive training and the foremost way of achieving this is by placing mathematics training

procedures in the right perspectives. Qualitative mathematics training ensures human self-sufficiency and national survival through skills, competencies and accuracy in all facets of life. Mathematics training is very important for life since it helps to quantify all the visible and invisible things with which we are dealing on daily basis. It is used as a tool to transmit sound practical facts by inculcating on our students and future leaders, mathematical, numerical, algebraic and statistical knowledge which will favour and orientate them in solving any health challenges and a powerful technique of analysis which can be used to prove or disprove theories or facts especially in health sector.

The Place of Mathematics during Pandemic

The role of mathematics in making wise choices when it comes to crises like the one we are facing (COVID-19) is similar to the foundation of a house, it is usually not seen but without it the house comes crashing down. Mathematical minds and their approaches to health crisis can lead to effective medical strategies with profoundly positive impacts.

One then will wonder how experts gain insights that lead to timely decisions, how they arrive at estimates of the number of people who might get infected, how experts virtualize the progress of the infection and its capacity to cross borders, the conditions for lockdown directives, and how experts can predict how long pandemic will last. All these and many other questions await detailed explanation and answers in mathematics.

Mathematical modeling in line with India Bio Science (2020) is one of the ways mathematics can be of help during any spread of pandemic. It generates a 'picture' of 'model' of the dynamic of the disease, which can be visually represented by graphs, charts, and tables. Mathematical functions can be applied as tools to describe the dynamics of how infectious diseases propagate among people. Health workers and relevant stakeholders make use of models to provide valuable inputs to visualize how diseases affect people, to access risks or to analyse intervention strategies to control or prevent

diseases. Also, they depend heavily on models to deal with the onslaught of issues that arise out of medical problems. They later translate the ideas into mathematical language, which draw a relationship between a physical quantity and its rate of change.

Modeling of a pandemic, according to Monash (2020), allows for predictions to be made about outcomes of particular courses of action which gives some insight into which action that will lead to the least objectionable outcomes.

COVID-19 and its Effect on Education

COVID-19 pandemic has affected educational systems world-wide, leading to the near-total closure of schools. Most governments, Nigeria inclusive, decided to temporarily close educational institutions in an attempt to reduce the spread. In response to school closure, UNESCO recommended the use of distance learning programmes and open educational applications and platforms that schools and teachers can use to reach learners remotely and limit the disruption of education.

Human Rights Watch (2020) highlighted some of the impacts the pandemic has spelt on the children's education in Africa, which are:

1. Unexpected pause in classroom education
2. Psychological disturbance over unusual stoppage and non-assurance of resumption to students.
3. The less-privilege children were totally cut off of on-line education as a result of costs of participating in such a new normal system of education.
4. Children living in rural areas were not able to link on a social platform because they have less access to mobile phones.

Some Strategies for Teaching and Learning Mathematics during Pandemic

Overcoming the challenges of teaching and learning at this period of COVID-19 seriously calls for proactive teaching strategies to bridge up the so called staggered classes and social distancing that have affected teaching and learning process as a result of emergence of the pandemic. At this time, teachers should not give chance or allow this crisis of pandemic to ruin their love for teaching and learning mathematics. Teachers can find

ways to be effective and attentive teachers amidst the madness happening around the world. They are expected to be creative and innovative in the course of teaching and learning mathematics during pandemic because the routines are geared towards the strengths and resources of diverse learners.

Ways to Achieve Effective Teaching and Learning during Lockdown

1 **Practice:** Teaching students online was not part of the curriculum; nevertheless, there is a role a teacher must fulfill until social distancing becomes a thing of the past. Although one should not expect perfection either from teachers or students, what they should be doing is practising. This can be in form of :

1. Practise having online hours to speak with your students.
2. Practise making answering students' e-mails a regular part of teacher's day.
3. Practise making a new curriculum that will teach your students what they need to know amidst the crisis the world is facing.
4. Practise using apps and teaching students how to use the technology they will need to continue getting education amidst the pandemic.

2 **Communicate with your students:** Communication is the key when it comes to teaching and learning online. As students continue to learn, they will be going to have a boatload of questions to ask. The teacher should try to create online hours so as to attend to students' problems or questions.

3 **Assign work that matters:** Learning and teaching online during COVID-19 is not the time to assign students with busy work. Teachers should provide students with relevant, helpful and engaging material(s). This can be done through:

1. Assigning stimulating or creatively challenging homework.
2. Having regular live-charts tutorials to ensure that students are grasping the work assigned.
3. Being funny and engaging as you teach.

4. Breaking learning up into smaller sessions that can easily be digested by anxious students.
 5. Trying to acknowledge a student's work, communicating on what they do right and what they can improve on.
- 4 **Being optimistic:** It is important for the teachers to be optimistic, especially when it comes to teaching students, the teachers should always use phrases like: when we're back in class together. Addressing the future with positivity can boost students' morale and keep their spirit up.

Ensuring Standards in the Quality of Mathematics Learning during Emergency Periods

The task of getting Mathematics involved during any pandemic or risky periods depends upon the type of Mathematics learning given to our younger generation now. For this to be achievable, all relevant stakeholders, like curriculum developers, SUBEB, TESCOM, Education officers, teachers, among others, are advised to follow these guiding principles in order to make their action visible and real. The principles, according to National Council of Teachers of Mathematics (2021) and Pearsonhighered (2021) are:

1. **Adequate Knowledge of Subject Matter:** For mathematics teacher to be effective, it requires that he/she should have a deep understanding of the mathematical content that the teachers are expected to teach and clear-as-crystal view of how students learn and how they can be supported to learn. This then calls for mathematics teacher to make use of his/her professional skills to disseminate instruction which, among others, can be achieved by:
 - Promoting students' learning and reasoning by engaging students in problem-solving with all multiple suggestions and different solution strategies.
 - Making connections among mathematical representation

to deepen understanding of mathematics concepts.

- Sharing mathematical ideas by analyzing and comparing students' approaches and arguments
2. **Access and Equity:** All relevant agencies must make it a point of duty to make mathematics curriculum available, support it with resources needed to maximize students' learning. This will in turn help in accommodating differences to meet a common goal of making students to be mathematically successful.
 3. **Curriculum:** The curriculum developers must ensure that mathematics curriculum is integrated and focused on importance of mathematics, and at the same time incorporates problems in contexts from everyday life challenges which will engage students and generate interest and curiosity in topics under investigation even after classroom activities. If this is done, it will help students to develop other ideas, link one idea to another and also illustrate the discipline of mathematics as a human persistent activity.
 4. **Tools and technology:** The government and all relevant agencies should provide enabling environment for the students so that they will be able to integrate the use of mathematical tools and technology so as to help them make sense of mathematical ideas, reason mathematically and at the end communicate their mathematical thinking. In addition to this, technology will help both the teachers and students to visualize and concretize mathematics abstraction, hence support effective teaching and meaningful learning will take place.
 5. **Assessment:** This refers to the wide variety of methods or tools that teachers use to evaluate, measure and document the academic readiness, learning progress, skill acquisition or educational needs of students. In other words, assessment is the process of gathering and discussing

information from multiple and diverse sources in order to develop a deep understanding of what students know, understand and can do with their knowledge as a result of their educational experiences (Westminster. edu, 2021). For this to be visible, it should not be done for doing sake for the students, but it should be done for the students to guide and enhance their learning. Also, teachers must use a variety of assessment techniques, understand their mathematical goals deeply and have common understanding of the mathematics that is been developed.

Process of Achieving Quality Mathematics Learning for Emergency

For the above quality to be realistic, the process through which the students gain and use mathematical knowledge must be sound and relevant so as to meet yawning demand. The process is as listed by pearsonhighhered.com (2021)

1. **Problems-solving:** According to Maheshwari (2017), students learn by working on problems. This enables them to learn new knowledge by facing the problems to be solved. With this method, students are expected to observe, understand, analyze, interpret, find solution and perform applications that lead to a holistic understanding of the concept. It also helps in developing brainstorming approach to learning concepts. In addition to this, it is an ongoing activity in which we take what we have known to discover what we don't know by overcoming obstacles by generating hypothesis, testing those predictions and arriving at satisfactory solutions.

Tips for effective use of problem-solving method are:

- i. Ask questions and make suggestions.
- ii. Teacher should help the students to understand the problem.
- iii. If students are unable to articulate their concerns, teachers

can be of help to determine where they are having difficulties.

- iv. Link errors to misconceptions or wrong ideas.
- v. Teachers should try to model the problem-solving process rather than just giving students the answer.

2. **Reasoning and proof:** Reasoning is a process of thinking during which the individual is aware of a problem, identifies, evaluates and decides upon a solution. On the other hand, proof is a fact, argument, or piece of evidence which shows that something is definitely true or definitely exists. Mathematical reasoning and proof offer powerful ways of developing and expressing insights about a wide range of phenomena. A mathematical proof is a formal way of expressing particular kinds of reasoning and justification. The teachers should know that the reasoning ability of a child is developed by solving proof tasks on which students' abilities in argumentation and justification are needed.

3. **Communication:** Merriam-Webster (2016) defines communication as a process by which information is exchanged between individuals through a common system of symbols, signs or behaviour. Mathematical communication entails a wide range of cognitive skills due to the fact that it deals with exchange of ideas; it encompasses both comprehension and expression. It is an essential part of mathematics and it is a way of sharing ideas and clarifying understanding. Through communication, ideas become objects of reflection, refinement, discussion and amendment. Communication of mathematics ideas will help students clarify and solidify their understanding of mathematics by sharing their mathematical understanding to their fellow classmates, teachers and parents. It also enables students to construct links between their informal, intuitive notions and the abstract language and

symbolism of mathematics. Furthermore, it plays a key role in helping students to make critical connections among physical, pictorial, graphic, symbolic, verbal and mental representations of mathematical ideas.

To crown it all, when students realize that some ways of representing a problem are more helpful than others, or when students see that one representation can describe many situations, they begin to understand the power of mathematics.

4. **Connection:** Connection refers to the ability to see and make more connections between mathematics ideas, between mathematics and other subjects and between mathematics and everyday life. According to Menanti, Sinaga and Hasratuddin (2018), mathematical connections are the interrelationships between mathematical topics, interrelationships between mathematics and other disciplines, and mathematical relation to the real world or in everyday life. Based on this, mathematical connections is the ability of students to link the concept of mathematics either between the concepts in mathematics itself or associate the concept of mathematics with concepts in their fields or with everyday life.

Mathematical connection is an ability that must be built and studied, because good mathematical connections will help students to be able to know the relationship between various concepts in mathematics and apply it in everyday life. With it, students will feel the benefits of learning mathematics, and the students' understanding of the concepts they learn will last longer. In addition to this, it will help to improve students' cognitive abilities such as recall and understanding of the application of environmental concepts.

5. **Representation:** Mathematical representations are visible or

tangible productions inform of diagrams, number lines, graphs, arrangements of concrete objects or manipulative, physical models, mathematical expression and formulas/equations that stand for mathematical ideas (Goldin, 2014). It shows mathematics to students who are trying to learn and to teachers who are looking for signs that help students to understand what they are being taught. The process of representation includes using models to organize, record and communicates mathematical ideas, as well as selecting, applying and translating these models to solve problems and interpret mathematics.

Benefits of representation for teachers and students

- Representation can be used for planning lesson note.
- It can be used by teachers to instruct and by students to solve problems and communicate their mathematical ideas to others.
- Teachers can also make use of representation to assess and improve students' performance and to make decision about future instructions.

Various Topics of Mathematics

- a. **Number and Operations:** These are the fundamental basis of all mathematics and teaching. This critical area is the first content standard for all beginners. All students must be taught to understand numbers and number systems, understand meanings of operations and how they relate to one another, compute fluently and make reasonable estimates. The ability to perform mental calculations and to calculate answers on paper is essential.
- b. **Algebra:** Students needs to be taught to understand patterns, relations, functions, represent and analyze mathematical situations and structures using algebraic symbols, use mathematical models to represent and understand

quantitative relationships and analyze changes in various contexts.

- c. **Geometry:** The overall goals for learning geometry are to analyze characteristics and properties of two and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, specify locations and described spatial relationships using coordinates geometry and other representational systems, apply transformation and use symmetry to analyze mathematical situations, and use visualization, spatial reasoning, and geometric modeling to solve problems. Common geometry skills used in everyday tasks include reading, describing and arranging.
- d. **Measurement:** This skill has many practical applications, as well as providing opportunities for advancing mathematical understanding and for practicing other mathematical skills, especially number operations (+ or -) and geometry. Students should understand measureable attributes of objects and the units systems, and processes of measurement, and apply appropriate techniques, tools, and formulas to determine measurement.
- e. **Probability and Statistics:** Students should also be able to learn how to select and use appropriate statistical tools/methods to analyze, develop and evaluate inferences, predictions and apply basic concepts of probability. These skills allow students to forecast possibilities or chances of an event based on given history of its occurrences or background characteristics. Also, it allows students to make sense of critical information such as medical students, the results of political survey, manufacturers to promote products etc.

A careful observation of these and many other mathematical topics shows that they are all related to nature and human daily activities, this is because mathematics knowledge arises from man's activities and attempts to solve a problem.

Obstacles to good quality of mathematics learning

There is outcry on obstacles to the good quality of mathematics learning and activities. Ojimba (2013) while quoting STAN (2002) listed the obstacles as follows:

1. Acute shortage of qualified professional mathematics teachers;
2. Exhibition of poor knowledge of mathematics content by many mathematics teachers;
3. Overcrowded mathematics classrooms;
4. Adherence to old teaching methods in spite of exposure to more viable alternatives;
5. Students negative attitudes towards mathematics;
6. Undue emphasis on the coverage of mathematics syllabuses at the expense of meaningful learning of mathematics concept;
7. Inadequate facilities and mathematics laboratories in our schools;
8. In addition to the above problems there is power and poor network problems.

Way Forward

In line with the above identified problems, Mathematics class size is becoming increasingly unmanageable, putting teachers in an impossible position of giving individual students the required attention. Hence, there is need for government and relevant stakeholders to recruit qualified Mathematics teachers to teach, manage and complement the efforts of those in service presently. Furthermore, there is need for government at various levels to add value to our educational system by trying to supply relevant and recent teaching materials to schools and make it a matter of necessity for every school to have Mathematics laboratories and forcing them to make use of it.

In addition to this, there is need for government to find a means of empowering all schools to have means of generating power and encouraging the service providers to have wider and functional coverage always so as to make network available. Lastly, there is need for all stakeholders to encourage mathematics students and teachers by giving

incentives that will boost their performances for good delivery.

Conclusion

The utmost desire of Mathematics teaching and learning in any society is to help students become intellectually sound, develop logical reasoning and scientific enquiry, and to help learners to see Mathematics beyond classroom boundaries. This implies that students must be brought to the real world of issues and relate the Mathematics they learn to the realities of life. Therefore, all relevant stakeholders should always have it at the back of their minds that the survival of any nations or society depends to a large extent on development and research, which is a function of the strength of mathematics teaching and learning.

Recommendations

The following, if implemented, will further enhance the quality of mathematics teaching and learning in preparation for emergency periods:

- i. The teachers should try as much as possible to emphasize the mathematical meaning of ideas, including how the ideas, concepts or skills, are connected in multiple ways to other mathematical ideas in a logically consistent and sensible manner.
- ii. There should be a classroom learning context in which students can relate meaning of mathematics concept to real-life situation or problems.
- iii. Also, teachers should endeavor to attend to students' meaning and students understanding in instructions because students' conceptions of the same ideas will vary as well as method of solving problems and carrying out procedures.
- iv. The relevant stakeholders should try as much as possible to incorporate culturally relevant practices into Mathematics learning instruction so as to achieve the desired results.
- v. In addition to this, the curriculum developers should always review and changed mathematics curriculum from time to time as occasion

demands and not waiting until it is obsolete before assessing it.

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