

Global Dynamics of Teaching and Learning Mathematics During the Period of Coronavirus Pandemic: Some Reflections from Nigeria

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ABSTRACT

The paper begins by bringing to the fore the universality of the COVID-19 pandemic and its attendant consequences in all human indices of development-health, education, aviation, infrastructure, tourism etc. across every continent, with varying degree of severity. The paper focuses on education sub-index – with a particular reference to Mathematics and how some aspects of Mathematics teaching have been deployed to provide an alternative solution to the dissemination of Mathematics, as well as other forms of knowledge. Thus, in education, teaching and learning Mathematics form the central thrust of knowledge transmission and acquisition in view of its bearing to every field of human endeavour. Therefore, the paper examines various stakeholders critical to the knowledge acquisition and dissemination, by arguing in respect of each stakeholder involved and how each of them is affected by the pandemic. The paper further argues that there is change in the conversation relating to teaching and learning vis-à-vis shift in or complete departure from what the system inherits from inception by ushering-in other teaching and learning possibilities such as the use of video-conferencing gadgets and software(s) like Zoom, Moodle, Skype etc. and even broadcast stations like television and radio. In the end, the paper suggests amongst other things, the need for overhauling the entire education system to allow for the inclusion of digital teaching and learning platforms via electronic means so as to prepare future generations against some potential future pandemics. Other suggestions include the introduction of distance learning as well as Open Educational Resources (OERs) and/or mobile software applications so as to reach out to students remotely since the pandemic had compelled everybody to stay at home. This, the paper argues, cannot be achieved without reviewing the current Mathematics curriculum which had not envisaged, nor had it taken care of this type of problem.

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Introduction

The emergence of the novel coronavirus (COVID-19) pandemic has had a profound impact on teaching and learning in virtually every field of human endeavor [1,2]. This is due largely to the fact that the virus has various means of transmission from one person to another, often at an alarming rate [3]. This occurs when there is physical and social contact between the carrier of the virus and the next person, through sneezing, coughing, handshake and through coming in contact with surfaces that have been infected. Experts believe that the virus affects ones' respiratory tracts, leading to severe pneumonia, difficulty breathing and ultimately death [4]. And the virus flourishes in a temperate climate. However, it does not survive in an environment that is hot and scorching, usually above 30°C, which accounted for the slow spread of the virus across African continent [5,6].

Now, teaching and learning involve physical and social contacts between teachers and their students and between students and their peers [7]. Similarly, both teachers and students interact with physical infrastructure in the school either within the classroom or outside, in the course of teaching, during laboratory work, or even during physical training [8]. In any case, the chance of contacting

the virus is high. Consequently, activities involving teaching and learning in the school must be hampered as a result. Furthermore, in order to stem the devastation of the coronavirus pandemic through non-pharmaceutical measures such as social distancing, quarantine, self-isolation, over hundred (100) countries around the world have resorted to the closure of primary, secondary and tertiary schools pending the stoppage and/or containment of the virus [9].

As a result, the scale of the devastation the virus causes across the world necessitated the World Health Organization (WHO) to declare COVID-19 a global emergency on January 30th, 2020 and a global pandemic on March 11th, 2020 [10]. As of the time the virus was declared a world health emergency, COVID-19 had affected 213 countries and territories in every continent except Oceania (WHO, 2020). Therefore, in response to the COVID-19 pandemic, several countries have resorted to the application of strict social distancing measures and a lockdown policy depending on their domestic needs and the extent of the damage occasioned by the pandemic in order to flatten the curve from becoming steeper. Unfortunately, in spite of these efforts by governments, the pandemic has had a far-reaching impact on schools, students and teachers [11,12]. By March 12th, 2020, 46 countries in five different continents have declared school closures and 26 of these countries have fully closed schools nationwide [13].

The Universality of COVID-19 Pandemic

Globally, every continent is affected by the novel coronavirus except with varying degree of intensity and devastation [14]. According to Cao et al. the virus emanated from China and pervaded to other parts of the world since December 2019 [15]. The index case was first recorded in the Chinese city of Wuhan in Hubei province [16]. Since then, continents have been recording cases of coronavirus country-wise, with the corresponding impact on various sectors of the economy of each country [17]. For instance, in Europe, Italy is the worst hit country, followed by United Kingdom (UK) while in Africa the worst hit country is South Africa. In North America, USA is worst hit and in South America, Brazil is the most affected country. In Asia, Philippines and India are severely affected and lastly, Oceania in which Australia is the most affected country. The economic consequences of this pandemic vary from one country to another, with the scale of devastation depending on the availability of resources – human, capital, infrastructure that would help in mitigating the scourge of the pandemic [18].

In universal terms, the virus had profound impact on a number of economic sectors world-wide. These economic sectors were categorized into three as primary, secondary and tertiary [19]. According to these researchers, primary sectors are the industries that are responsible for preparing raw materials for production; secondary sectors are in charge of the production after raw materials must have been extracted and prepared, and then tertiary sectors that are considered to be essential service providers. Other sub-sectors associated with these three categorizations include, agriculture, oil & gas, manufacturing industries, aviation, markets, health care and pharmaceutical industry, education, hospitality and tourism, sports industry, real estate and housing sector, information technology, family dynamics, media etc.

In education for instance, coronavirus had affected all levels of education, from pre-primary, primary, secondary and tertiary with a variation in the degree of the devastation. Activities in education range from teaching, research, learning as well as community service. Each of this education sub-unit had been adversely affected by the pandemic. Teachers could not teach, nor can they conduct research, talk more of rendering services for their communities. Initially, students found it difficult to engage in learning but later, they were remotely engaged in learning through various means such as internet, television and radio stations. Using internet, virtual means such as Zoom, Skype, and Moodle etc. were used in the teaching.

Teaching in the Period of COVID-19 Pandemic

Teaching is the process of interaction between the conveyer (teacher) of knowledge and the recipient (learner) of that knowledge in what has been referred to as delivery and reception theory [20]. This process is an essential part of entire education system. Thus, education is the knowledge, skills, values, beliefs, and habits disseminated and/or transmitted to the learner through the instrumentality of the teacher [21,22]. In order to achieve this, suitable and relevant approaches and/or strategies such as training, storytelling, discussion and online/virtual teaching have to be employed. Education frequently takes place under the guidance of educators usually within classroom setting [23]. However, learners can also engage in self-learning and educate themselves through other means such as online education programmes like Khan Academy, YouTube outlets, as well through social media like Facebook, WhatsApp etc. Thus, education can take place in formal or informal settings and any experience that has a formative effect on the way learners think, feel, or act may be considered educational in nature [24].

Consequently, the emergence of coronavirus had changed how teaching and learning were formally considered to be – a normal and/or traditional student-teacher interaction in the classroom [25,26]. The change was necessitated by high transmissibility of the virus which may not allow for physical interaction between families within the same household, let alone in large gatherings like school. Should the latter happen, it may lead to what Fauci described as “super spreader” event. So, this led to a greater level of introspection on how teaching would be carried out, without jeopardizing the future of students as well as ensuring their safety. Many countries resorted to virtual teaching and learning in an atmosphere of serenity to both teachers and students. However, this process is not without its conundrums.

One of the major hiccups associated with this mode of learning is its expensive nature. In addition to the need for a strong internet signal through large bandwidth, the system requires uninterrupted supply of electricity and capable workforce – who can handle and/or manipulate the electronic gadgets and virtual environments seamlessly. However, most of these problems are widespread in African countries; and therefore, the process of teaching during the pandemic was a challenging task. For instance, Oyelaran-Oyeyinka and Adeya, citing Kenya and Nigeria on the availability and access to internet services argue that, in addition to cost, which is not affordable to most academics, policy was also fingered as a problem bedeviling the usage and adoption of internet in the two countries. Similarly, the literacy level of computer amongst Nigerian populace is low, owing to low penetration of computer in the country. In their study of undergraduate students’ computer literacy, Danner and Pessu observed that in spite of the increasing role of computer in the society, majority of people in Nigeria are not familiar with most of the packages in computer such as word processing package, power point, excel and internet.

Therefore, teachers have challenges when it comes to technology and knowledge dissemination and transmission through electronic media. So, at the peak of the pandemic, when most countries around the globe adopted e-teaching as an alternative to physical contact between teacher and students, Nigeria was far behind.

Learning in the Period of COVID-19 Pandemic

Learning is said to occur when one acquires new knowledge, aptitude, skills, values, attitudes, and have a relative change in behavior. The ability to learn is exhibited by human beings, animals, and in some instances, machines [27,28]. Some learning abilities are immediate, occasioned by a single event (e.g. responding to a stimulus), but in most cases, knowledge is garnered from repeated experiences one had contact with (Bradshaw, Dunleavy, Garner, Preston, Bajwah, Cripps & Walshe, Noy) [29,30]. Some changes arising from learning last a lifetime, and it is hard to claim to lose information that has been learnt permanently. This learning traditionally takes place in a classroom setting, with teacher as the leader in the process, observing all the teaching protocols designed by the relevant bodies through various curricula documents. The process involves physical interaction and exchange of views between teacher and his learners. All these were made possible prior to the emergence of coronavirus pandemic. Learning now becomes remotely taken at home through online classes, Zoom video conferencing or through pre-recorded audio or video contents. In some countries, some TV stations were chosen to air teachers when they are teaching for the children at home to watch and benefit from. In tertiary institutions, data bundles were provided to students to use in their rooms and link up with their lecturers virtually. This had helped greatly in providing

virtual access for students so that no one missed their classes due to the pandemic. However, in remote areas, where electricity was a challenge, authorities resorted to providing educational programmes through radio stations.

Mathematics Teaching in the Period of COVID-19 Pandemic

Mathematics, like other subjects suffered in no small measure the inability of its teachers to effectively teach it remotely. This is due largely to the fact that many topics in Mathematics are not cognition-based. They require physical presence of teacher to teach them. For instance, any topic requiring psychomotor skills to be taught may not be well learnt when teacher is absent. To draw a line, instruments like ruler, protractor and pencil have to be used. But when it is to be taught virtually, many students would find it boring and dreadful to learn how to draw a line from someone virtual to them. For instance, in their study on digital technology and Mathematics education, Mulenga and Marban found that digital teaching platforms offer enormous opportunity for prospective teachers in teaching Mathematics especially when it is facilitated through social media outlets [31]. However, the cluster analysis result used in the study showed an unstable pattern, in which some participants displayed low understanding of digital technology in teaching Mathematics.

Furthermore, Mulenga and Marban argued that in order to maintain learning and effective teaching during a school closure via some means possible is imperative in order that students can be kept abreast of their learning [31]. In support of this assertion, Burke and Dempsey posited that in an attempt to re-shape education, there are certain measures that need to be implemented during the COVID-19 school closure. Such measures include but not limited to; maintaining communication with students, parents, teachers and other staff members through e-mails and phone calls, ensuring access to learning outlets like Google Apps (e.g. Google Drive, Dropbox, and other cloud storage) for education, Moodle Cloud, Edmodo, or social media tools (e.g., WhatsApp, Twitter, YouTube, Facebook, Instagram, Yahoo etc.) and maintaining access to data via cloud computing for servers and back up in a location other than the school [32].

Mathematics Learning in the Period of COVID-19 Pandemic

Research on the impact of COVID-19 global pandemic on Mathematics learning was tremendous. Several researchers have conducted studies on mathematics knowledge that is required to be learnt during the COVID-19 crisis. Many of such studies were unanimous in adopting a digitally-inclined approach to the teaching process which ultimately guaranteed effective Mathematics learning. For example, Iwai conducted a study on online learning during the COVID-19 pandemic [33]. His argument was on the pros and cons of students' gains and losses when classrooms go virtual. Similarly, Agnoletto and Queiroz posited that the logic of going digital in learning is not simple; however, there was an immediate outcry for the need to launch digital tools as an emergency measure, in order to adopt the use of digital-technologies for learning [34].

In another study in China, considered the epicenter of the outbreak, looked at how social media technologies like Sina Microblog were used to arrest the attention of the public to COVID-19 pandemic [35]. The study revealed that social media platforms (e.g., Sina Microblog) were used to disseminate information and learning as well as measure public attention to public health emergencies. Through social media platforms, the government communicated important information to the public, reviewing the

health guidelines and sensitizing citizens on what needs to be done including learning. A study by Roy in Australia, presented some tips that, if adopted, could help children learn from home during the covid-19 period [36]. In one of the tips, Roy suggested that teachers need to download some teleconferencing facilities (e.g., Skype, Zoom, Lifesize etc.) that may be used to deliver lessons remotely without the physical presence of the teacher.

Some Reflections in Nigeria's Context

Nigeria was not left out in the global quest for putting the COVID-19 pandemic out. Since the index case was recorded on 27th February, 2020 in Ogun state (ref), the country was plunged into unprecedented chaos. Cases of deaths were recorded in every nook and cranny of the country, with varying degree of frequency. Health facilities were overstretched and many sectors such as aviation, transportation, education and tourism were affected in no small measure. In education for instance, all institutions from primary to tertiary level were closed down after the Federal Government of Nigeria (FGN) through Federal Ministry of Education (FMoE) issued a circular to that effect. Similarly, state governments through their various State Ministries of Education (SMoE) issued similar circulars to the effect of immediate closure of all the schools in order to curb the spread of the pandemic or reduce it to the lowest level possible. In order to address the problem, the FGN inaugurated COVID-19 presidential task force to explore ways to address and manage the crisis. Chaired by the Secretary to the Government of the Federation (SGF), the composition of the committee included the National Coordinator, Minister of Health, Minister of Humanitarian Affairs, Disaster Management and Social Services, Minister of Interior, Minister of Aviation, Minister of Education, Minister of Information and Culture, Minister of Environment, Director State Security Services, Director General Nigerian Centre for Disease Control (NCDC) and WHO country Director.

Suggestions

In line with the paper, the following suggestions were offered

- Curriculum of Mathematics at all levels should be reviewed to allow for inclusion of digital gadgets in teaching and learning.
- Access to internet should be made available to both teachers and learners of Mathematics in order to enable them get teaching and learning materials easily in the event of any future outbreak/pandemic.
- Teachers should be trained on how to handle digital media and use electronic apps that enable online teaching and learning like Zoom, Skype, Google Meet etc.

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