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Pandemics and Education in Sub-Saharan Africa: Invest in Education Technology

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Abstract The current outbreak of COVID19 has reflected unanticipated dynamics in the learning programs and a shift in the delivery of learning both in developed and developing countries. It has also depicted the existence of limited preparedness in most countries to confront the effects of global pandemics, especially in teaching and learning. The COVID19 pandemic has occasioned significant negative effects in the learning systems, a factor which calls for long term measures to ensure that the educational programs should not or never be severely disrupted during pandemics. The overall objective of learning programs during disease outbreaks is to ensure that the transmissibility of the disease pathogen is curtailed within the population and continuity of learning. This will subsequently enrich a healthy learning environment that will promote the achievement of the intended goals and learning outcomes. This study intends to investigate the impacts of pandemics in primary and secondary school learning in Sub-Saharan Africa countries, technological preparedness in schools, and suggest remedial measures.

Keywords: *pandemics, COVID19, Sub-Sahara Africa, education technology, open learning*

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1. Historical Perspective of Pandemics in Africa

With the fewer number of deaths from COVID19 compared to other countries, African countries have always registered the highest casualties from most disease outbreaks. Some of the common outbreaks that are currently ravaging or ravaged Africa in the recent past include HIV/AIDS, cholera, and Ebola. A previous pandemics of flu virus in 1918 killed between 20 to 50 million people in Africa while the HIV pandemic as of 2018 had killed 40 million people [1,2]. However, as it is now it is impossible to determine the outcome of the impacts COVID19 in Africa since its effects are still taking place. These pandemics result in severe consequences in teaching and learning in these countries.

2. Related studies on Pandemics and Education

Closing of schools can be an effective way of reducing contact especially if the attack rates among children are higher than adults [3]. Schools are presumed to harbor large populations which may delay the peaks of the pandemics when closed, create sufficient time to process vaccines, and for public health officials to come up with community measures that may limit the spread. However, the main question is whether academic institutions are efficient in reducing the spread of highly infectious disease and lowering pandemic peaks while at the same time enhance significant learning. [4] investigated the effect of closing schools and the timing of the epidemic peaks based on avian influenza A(H7N9) outbreak in China. This study realized that school closures alone are not sufficient to lower pandemic peaks without the deployment of vaccines and other treatment regimens [4]. This is because it is difficult to quantify the possible benefits of school closures despite schools being useful in controlling pandemics particularly un reducing the peaks [3].

3. Pandemic Preparedness in Sub-Sharan African Countries and Schools.

The COVID19 pandemic revealed that closure of schools is one of the mitigation strategies against rapid spread of viruses [5]. The outcome of the 2009 H1N1 influenza pandemic also revealed that operational guidelines associated with school closures like duration of closures, the exact time when closure should be initiated, and type of school closures result in interventions that vary between different countries [6]. These variations can be reflected globally with some countries mitigating faster and more effective than others to prevent pandemics. The efficiency at which mitigation factors put in place to limit pandemics by respective countries drains down to

how functions in other departments including education programs are affected. It is, therefore, almost obvious that African countries may experience lack of pandemic preparedness in schools and subsequently impart severe negative consequences in teaching and learning.

As a precautionary measure, before the 2009 H1N1 pandemic, the World Health Organization (WHO) directed member countries to develop preparedness plans that will ensure timely response to new pandemics [7]. An overall assessment of 37 preparedness plans that were submitted and randomly selected from 47 countries depicted that pandemic preparedness plans across most of the WHO African states were inadequate, weak, and lacked operational clarity [7,8]. A most recent study by [9] on preparedness to the next phase of COVID19 in Africa has suggested that response by many countries is more promising and appear to be progressive despite high economic constraints experienced. However, findings from [9] and other ongoing studies on COVID19 in Africa cannot offer a logical conclusion on pandemic preparedness since its impacts are still in place and vary between different countries. Other recent studies demonstrate several shortcomings in pandemic preparedness in African countries', factors that demand better measures to curtail negative effects in teaching and learning.

4. Impacts of Pandemics in Sub-Saharan African Schools

4.1. Magnification of Already Existing Problems

Even before the COVID19 pandemic, over 258 million school-going children in both primary and secondary schools were pushed out of school in Africa [10]. This adds to millions of students who are already out of school due to poverty and other social-economic factors [11]. A report by the [10] noted that 53% of school-going children in Sub-Sahara Africa are learning poor. This means that over half of all 10-year-old children cannot read and understand a simple age-appropriate story. Continued closure of schools will create possibilities that will completely lock out these students from resuming classes when school reopens probably in 2021.

4.2. Redefinition of Educational Approaches

Previous epidemics have redefined teaching and learning in some parts of Sub-Saharan countries. This ought to serve as important models in offering practical and effective solutions to future epidemics. The HIV epidemics in the mid-1990 in South Africa resulted in many deaths which obligated teachers to take responsibilities that are traditionally held by parents [12]. This deprives teachers their ample time to prepare lessons and effectively implement the learning objectives. Also, unlike developed countries, most schools in Sub-Saharan countries do not have school counselors stationed within the school building. Teachers too are not trained in physical, emotional, and cognitive support required by learners which results in a lack of psychological support to learners especially those who have lost parents due to epidemics. These challenges overcome educational programs and significantly affected the learning process. The aftermath of these trials challenged some learning institutions or countries to establish programs necessary to curb severe implications associated with epidemics.

4.3. Decline in Student's Enrollment

Five million children were affected by school closures due to Ebola pandemic across Guinea, Liberia, and Sierra Leone and teenage pregnancy rose by up to 65% in Sierra Leone alone [13]. A study investigating the post-epidemic impacts of the 2014 Ebola epidemics in Sierra Leone during the 2014-2015 academic year realized that there was a decline in student enrollment in schools by 16% and unprecedented pregnancies among school-going girls aged 12-17 years [14]. The loss of students from schools due to pregnancies contributed to the decline in the number of student enrolments in schools and further hindered the opportunities of these young girls to discover their long-life skills and abilities.

4.4. Access to Education

Within four months (March to July 2020), COVID19 had adversely affected educational programs across several countries in the Sub-Saharan limiting both student's and teacher's access to learning facilities. With the continued prevalence of COVID19 pandemic and closure of learning institutions, long periods of learning will be lost [15]. This a double tragedy to countries that are already straining to address access to education, economic discrepancies, infrastructure development, poverty reduction, management of natural resources, and health services. Substantial amounts of budgets allocated for the management of educational services have been diverted to cater for health programs to counter the impacts of COVID19. Liberia government temporarily diverted $9.5 million from pre-existing projects to finance the health sector and reduced spending in departments that deemed to be non-essential during the pandemic period secure enough budget allocation to the Ministry of Health [16]. This diversion of funds intended for education programs creates artificial deficits that affect the department preparedness during emergencies and may significantly affect the revitalization of normal programs when normalcy returns.

5. Challenges on Educational Technology in Sub-Sahara Africa

Physical attendance in schools all over the world has been significantly affected because of the COVID19 pandemic. Unlike Africa, most schools especially in Western countries comfortably shifted to the online mode of instruction delivery. Online delivery of instruction in developed countries is more effective, despite a few challenges, because of better educational and technological resources at their disposal. Data collected by [17] shows that approximately 99% of public schools in the US have

a high-speed broadband internet connection and 87% of the teachers use digital learning in their instruction. This high access to technology is sufficient to meet a substantial amount of educational demands especially in languages, humanities, and the theoretical components of science subjects. The use of technology has been used for teaching and learning during conventional periods of instruction devoid pandemics and, therefore, sudden school closures during pandemics may not be greatly impacted. This is unlike African countries which are struggling to ensure increased and better technological access in education and quality of life to its citizens due to persistent population growth coupled with high school enrolment, and poor institutional infrastructure [18,19].

6. Way Forward of Learning during Epidemics in African Countries

6.1. Investment on Information and Communication Technologies (ICT).

As early as the 2000s, institutions of higher education in the Sub-Saharan continent had started conceiving possibilities of improving higher education through information and communications technologies (ICTs) [20]. Successful investment and implementation of ICT programs in the educational systems in Africa at that time could have significantly curtailed the impacts of the subsequent epidemics and current Covid19 that have ravaged educational programs in Sub-Sahara Africa. For example, on July 7th, 2020, just four months into the COVID19 pandemic, the Kenyan government and most of other African countries announced the closure of schools for the remaining part of the year and considered the academic year 2020 as lost. All students will repeat the same class 2021 [21].

6.1.1. Remote Learning

Remote learning could have provided a better alternative for facilitating education during pandemics. Enhancing remote learning highly depends on the availability of internet sources. However, education technology in Africa as depicted in the table below is very low with 28.2 % of the Sub-Saharan population having access to the internet [22]. Without internet, nothing much can be achieved in terms of remote and distance learning.

Table 1. Statistics of Internet Users by Region

Country	2017	2019
Africa	21%	28.2%
America	65.9%	77.2%
Arab States	43.7%	51.6%
Asia and Pacific	43.9%	48.4%
Commonwealth of Independent States	67.7%	72.2%
Europe	79.6%	83.5%

6.1.1.1. Challenges of Remote Learning.

Data from Internet World Stats show that at least one-half of the Sub-Saharan African countries have less than 50% of their population with no access to the internet. Only 10% of the population of poorly developed Sub-Saharan countries like Rwanda, Burundi, Chad, Madagascar, South Sudan, and Western Sahara countries have access to the internet [23]. These limitations further complicate the need to implement remote learning or any other instructional methods that are facilitated by the internet. Such demerits that face most of the Sub-Sahara Africa countries demand for comprehensive measures in terms of preparedness and resource allocations to limit negative educational consequences arising from epidemics and pandemics.

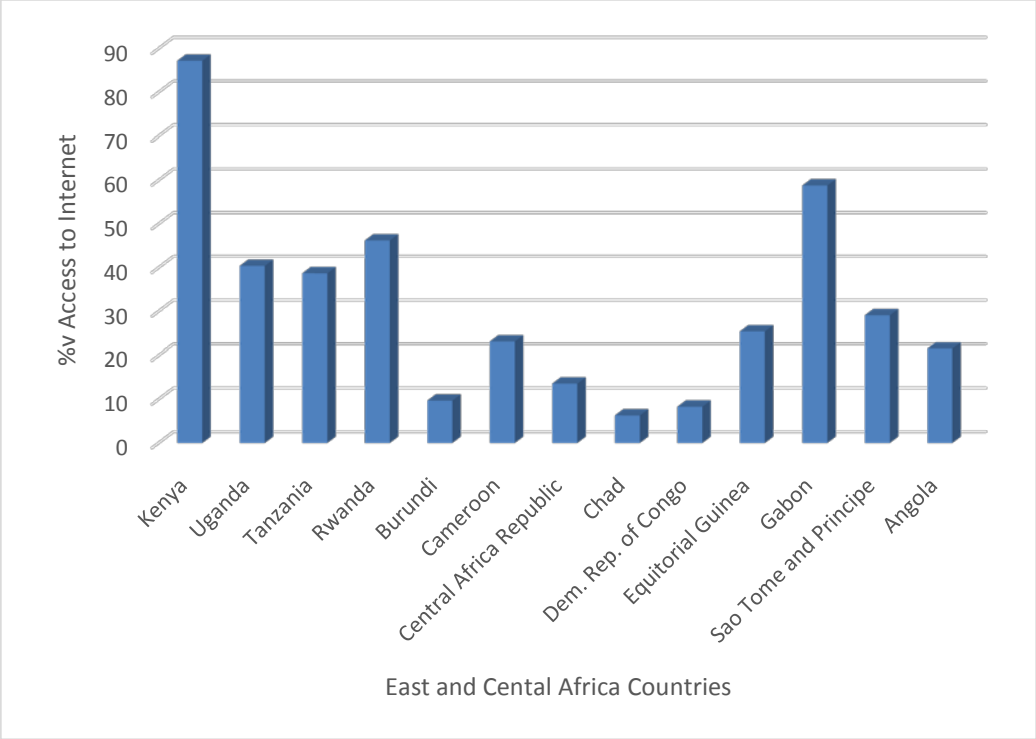

Figure 1. Statistics of internet Users in East and Central Africa

6.2. Interactive Radio and Audio Learning Resources

Countries like Liberia which had been wrecked by Ebola virus epidemic in 2014-2015 learned from the previous experience to ward off severe repercussions in their educational programs. This is evident from their response to the COVID19 pandemic. Schools in Liberia started airing lessons through radio stations within the first two weeks after the pandemic had been pronounced and the first coronavirus case was confirmed in the country [24]. This suggests that the use of radio stations can be one of the easiest and cheapest alternative educational resources to broadcast lessons during pandemics in developing countries especially in regions where the internet is limited or unavailable. However, this is not something new in Africa. Historically, schools have used Amplitude Modulation (AM) and Frequency Modulation (FM) radio waves to teach.

Because of wide coverage and low cost per unit, radios can be harnessed to facilitate learning, improve educational quality, and developing abstract thinking through active listening and imagination [25]. Proper planning and design of curriculum coupled with accurate schedules with other educational stakeholders including parents and learners can effectively implement the use of radio for learning with considerable achievements. This approach can further be enhanced by using both audio and video cassette recorders for nonpractical subjects such as languages and humanities [26]. The use of radio in teaching was common in some East African countries like Kenya (as early as 1960) and well-developed Asian countries like Eastern Parts of Asian countries like Malaysia (Sabah and Sarawak cities) up to the early 2000s as the traditional mode of teaching [26,27]. Since this system has proved to be effective before in some Sub-Saharan Africa countries and other parts of the world, it is therefore evident that it is a relevant and adaptable mode of instruction that can substitute the conventional instruction modalities during pandemics.

6.3. Implementing Distance Learning

Since the post-colonial era, most of the Sub-Saharan Africa countries have encountered an array of challenges ranging from cultural and intellectual independence, economic, technological, and political challenges that have significantly affected their educational programs - both teaching and learning [28,29]. These challenges coupled with constraints in learning space due to population, epidemics, and most recently COVID19 pandemic call for the need to embrace novel learning systems that will allow uninterrupted delivery of instruction during unique times. Distance learning approach appears to be one of the best options for delivering instruction during such times of pandemics [30]. Although this study did not delve much on the relevance of distance learning during pandemics, it affords potential solutions that applicable school closures during pandemics. This study asserts the highly projected enormous potential of distance learning/eLearning in Sub-Saharan Africa through Open Educational Resources (OER) and Open Distance and eLearning (ODeL) [30,31]. Another study by [32] observed that collaborative systems between eLearning patrons, education policymakers, telecommunication, and internet service providers, and educators may offer solutions to education problems in Africa. Sub-Saharan Africa governments should, therefore, create special emergency departments under the Ministry of Education and allocate sufficient funds to run eLearning, avail unlimited learning resources through OERs, and support alternative educational programs that can substitute or complement the traditional classroom instruction during emergencies through online resources.

7. Open Learning Resources (OER)

Open educational resources (OER) avail unlimited accessibility of learning materials to teachers and students on the web for public use under the open license of creative common [33]. This approach utilizes technology to facilitate a collaborative and adaptable learning environment through open sharing of teaching and learning practices [34]. The United Nations High Commissioner for Refugees (UNHCR) initiated Open Learning Exchange (OLE) programs in some countries of Sub-Saharan Africa which employed OER to expedite learning in refugee camps [35]. This program successively achieved its educational outcomes on the quality of the fundamental learning system in basic literacy and early elementary education for both public and private schools as well as in community centers in inner cities and remote villages. The OLE approach of instruction has successively worked in refugee camps in Sub-Saharan African countries and can, therefore, be replicated on a large scale to offer controlled instruction during pandemics as an alternative form. OLE can work independently, complement, or supplement the traditional forms that may be available to fill in gaps created by school closures.

8. Investment in Education Technology

The basic investment in education technology includes availability of internet, computers, and tablets and everything that can facilitate entire online instruction, programs, class discussions, and data analytics. Worldwide expenditure on education technology and training is estimated to be $4 trillion, while in Africa alone, the cost of eLearning in Africa was estimated to be US$ 513 million [36]. Compared to other Sub-Saharan countries, Kenya, Uganda, Botswana, Rwanda, and South Africa have invested heavily in eLearning projects.

In 2009, the Kenyan government through the Information and Communication Technology (ICT) authority initiated two phases of National Optic Fibre Backbone (NOFBI) to install optic fiber covering 6,400 km (3977 miles [37]. This was aimed at ensuring that all the country's counties have internet connection. Rwanda has completed a 2,300 km (1,430 Miles) fiber-optic connectivity at a cost of US$95 million to boost access to various broadband services including eLearning [38]. The fiber-optic connectivity enabled the availability of internet connection as early as 2011 which led to the establishment of a 7-year government plan on projects and initiatives supported by open, distance, and eLearning (ODeL) in Rwanda [39]. This

project revealed that ODeL achieved its objectives in transforming online instruction. It offered a framework that is instrumental in creating policies and strategies in open learning programs such as the establishment of courses, capacity building, and using technology in teaching and learning. Botswana government allocated US$ 3 million in the ministry of Education and Skills Development to develop a digital studio that will enhance high quality and accessible lessons through radio and television media [36]. These funds are also used in professional development training for its teachers on new digital learning through partnership with Microsoft.

Despite the reasonable connectivity and use of the internet to some large populations in Sub-Sahara Kenya, Rwanda, and South Africa, this did not in any way facilitate the use of distance learning to mitigate the loss of learning during the COVID19 pandemic. There is, therefore, a need for the sub-Saharan African countries through the relevant agencies to not only budget and allocate funds for education technology, but immediately start ensuring reasonable school connectivity and availability of mobile devices such as tablets, Chromebooks for students to carry home [10]. There is enormous digital content available in open sources initiated by Sub-Saharan governments, however, this content has not been availed in educational institutions for teaching and learning purposes.

9. Conclusion

Most of the Sub-Saharan governments are the key educational stakeholders who institute measures to mitigate, manage, and promote educational programs during pandemics. The government assigned institutions must shoulder the responsibility of ensuring continuity of educational programs in manners that do not subject parents and learners undue emotional stress and loss of learning. To effectively maneuver through these challenges, respective governments ought to enact education emergency policies in place to address immediate, short-term, and long-term emergency programs. These policies should be allocated sufficient funding, remunerated management committees, and have educational infrastructure put in place. Whereas school closures appear to part of the most appropriate and immediate solutions meant to reduce infection rates and epidemic/pandemic peaks, education programs should not stall as what has happened during the COVID19 pandemic. School closures should be a short-term solution to pandemics. This study observed the emergent need for a long term or permanent solution to curb negative consequences on education programs in Sub-Saharan Africa due to epidemics [40]. Long term solutions should focus on putting programs in place that ensure continuity in learning for every African child during epidemics or pandemics. The strongest and most formidable investment should emphasis on education technology to expedite remote learning. The most immediate investment in education technology should focus on increasing access to digital resources by improving connectivity through low bandwidth and making instructional content available through available devices. World Bank Education Globe Practice suggested that policies and funding defined by the government should build a multifaceted remote learning model with an inventory of existing content [40]. These inventories should be deployed via remote learning in alignment with the traditional or existing school curriculums so that the learning opportunities correspond with the already established learning objectives. Supporting the use of low bandwidth (including offline) solutions using mobile remote learning models/devices can make content available for learning through WhatsApp and Facebook. With sufficient bandwidth, videos of teacher teaching can offer helpful learning resources and engaging content through social media.

Because of limited internet resources in Sub-Sahara African countries, the study observed reliable alternative avenues utilizing offline remote learning resources via printed material such as textbooks, print study guides, and projects for students to use at home as being workable methodologies. Implementing remote learning through educational radio and television programs appeared to significantly support learning in the Sub-Saharan countries during pandemics.

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