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ABSTRACT

The coronavirus (COVID-19) disease has affected the global community at an alarming rate. The pandemic affected regular business globally. Despite the role schools play in raising learners' skills, they had to be closed. To mitigate the impact of COVID-19 on education, the education sector should focus on the role of Massive Open Online Courses (MOOCs) in basic education institutions. In Kenya, MOOCs have been adopted in institutions of higher learning. However, there is no evidence of information technology being implemented in basic education institutions. The study examined the impact of COVID-19 on education. It also assessed the role of information technology as a communication mode in mitigating the COVID-19 pandemic. Furthermore, the study discussed online initiatives that are crucial in mitigating the impact of the coronavirus.

Keywords: coronavirus, schooling, trends, elearning.

Classification: FOR CODE: 139999

Language: English



London
Journals Press

LJP Copyright ID: 573333
Print ISSN: 2515-5784
Online ISSN: 2515-5792

London Journal of Research in Humanities and Social Sciences

Volume 22 | Issue 2 | Compilation 1.0



Coronavirus Era: Implications for Massive Open Online Courses in Basic Education Institutions in Kenya

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ABSTRACT

The coronavirus (COVID-19) disease has affected the global community at an alarming rate. The pandemic affected regular business globally. Despite the role schools play in raising learners' skills, they had to be closed. To mitigate the impact of COVID-19 on education, the education sector should focus on the role of Massive Open Online Courses (MOOCs) in basic education institutions. In Kenya, MOOCs have been adopted in institutions of higher learning. However, there is no evidence of information technology being implemented in basic education institutions. The study examined the impact of COVID-19 on education. It also assessed the role of information technology as a communication mode in mitigating the COVID-19 pandemic. Furthermore, the study discussed online initiatives that are crucial in mitigating the impact of the coronavirus. The study was guided by e-learning theory as advanced by Richard E. Mayer, John Sweller, and Roxana Moreno in 2015. A mixed-method approach was used in the study. A study sample of 384 was drawn to conform to the confidence interval of 0.05, a confidence level of 1.96, and a standard deviation of 0.5. Regression analysis was used to test the hypothesis of the study. The study findings might be significant stakeholders for the actualization of e-learning in schools.

Keywords: coronavirus, schooling, trends, elearning.

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Objectives

- Examine the impact of Coronavirus on Education.
- Assess the role played by schools.
- Discuss online initiatives that can mitigate the impact of the Coronavirus

Hypothesis

Ho: Massive Open Online Courses do not significantly mitigate the impact of COVID-19 on Education.

I. INTRODUCTION

A novel coronavirus, known as COVID-19, is reported to have originated in Wuhan, China, in December 2019 (Huang *et al.*, 2020). According to Pokhrel and Chhetri (2021), the global outbreak of the COVID-19 pandemic has spread worldwide, affecting almost all countries and territories. The World Health Organization (WHO) declared COVID-19 a pandemic on March 11th, 2020. Thus, a global emergency is impacting the entire world population, the economy, and education is no exception. The novel coronavirus is a new strain of Coronavirus that has not been previously identified in humans. It spreads like wildfire, and the global rate of infection is high. With the upsurge of the virus, the World Health Organization (WHO) declared the virus a pandemic. Besides, WHO came up with strategies on how to deal with the COVID-19 pandemic. Social distancing and wearing face masks were crucial since the virus spread through saliva droplets. Hand-washing was also identified as being more appropriate since handwashing with soap or sanitizer dissolves the virus. Leading pharmaceuticals companies in developed countries embarked on the development of vaccines to

counter the pandemic. Although Pfizer, Moderna, AstraZeneca, Johnson & Johnson, and sputnik V vaccines have been developed for COVID-19, it is unclear whether all countries will access them.

Vaccines are currently administered to people in developed countries and a few developing countries. Despite the efforts to develop vaccines for COVID-19, a new variant has been discovered in the U.K., Nigeria, the U.S., and 11 other countries (University of Edinburgh, 2021). The variant, B.1.125, contains a mutation in the virus's spike protein. The mutation is also present in the variants that have been found in South Africa and Brazil. Another variant, B.1.1.7, has been identified in the U.K. The variants bind and enter human cells. Also, the viral variants from South Africa, the U.K., and Brazil are more contagious. Subsequently, the new variant is a threat as current E484K vaccines might not be effective. Besides, by January 2021, the Delta variant was identified in India. It is more contagious and has a high transmission rate globally, so it has become a concern. WHO is closely monitoring and tracking the variant. Various countries have demonstrated the variant. Africa, and specifically Kenya, has not been spared. The increased transmission rate of the Delta variant is due to social mixing, increased social mobility, and the inappropriate use of public health and social measures.

Since March 2020, COVID-19 has spread at an alarming rate in sub-Saharan Africa. Half of the countries in this region are experiencing community transmission of the virus. COVID-19 has also become asymptomatic. Asymptomatic means a condition where a victim does not show disease signs. Most COVID-19 positive cases do not show signs of COVID-19. Globally, by July 2021, about 193 million people had been infected. Besides, around this period, the virus killed 4.14 million people all over the world. Sub-Saharan Africa has recorded a caseload of 2.86 million positive COVID-19 cases by July 2021. Also, 14,956 people in sub-Saharan Africa succumbed to death by May 2020. On March 13th, 2020, a traveler from London was diagnosed with the first positive COVID-19 case in Kenya. As of April 27th, 2020, there were 363 confirmed cases, 114 recoveries, and 14 deaths (12 males and 2 females)

in Kenya. There is sustained local transmission, accounting for 58% of all cases, while 42% are imported. At first, Nairobi was the epicenter of the epidemic, which has now spread to 12 more counties, with Nairobi and Mombasa leading with 235 cases and 93 cases, respectively. More males were infected (56%-198) and most of the confirmed cases were asymptomatic (71%-251) (Nanyingi, 2020). Since then, the country has recorded 195,801 positive cases and 381,041 deaths by July 2021. Also, the country fell short of the supply of testing kits for COVID-19. This is an indication that the COVID-19 testing levels are low.

To mitigate the spread within the country, typical business activities had to be halted, including: mandatory quarantines and a countrywide night curfew, closure of clubs, restaurants, and non-essential businesses, suspension of international flights, partial lockdowns in five hotspots (Nairobi, Mombasa, Kilifi, Kwale, and Mandera) and the closure of international borders (Pravat, 2020). In addition, public service announcements emphasize policies such as social distancing, working from home, a ban on public gatherings, and fewer passengers in public vehicles. Moreover, educational institutions were closed despite the crucial role schools play in raising learners' skills. Researchers view site attendance or face-to-face contact as essential in increasing children's social skills and social awareness. Studies have revealed that schooling has significantly impacted the improvement of students' scores on tests. Besides, economists consider school attendance crucial for the development of a child's productivity ability. But COVID-19 has interrupted learning in schools. Schools closed down due to the COVID-19 outbreak. The effect negatively impacted regular school attendance. Kenya had to adopt strategies identified by WHO to respond to the impact of the coronavirus. Social distancing, the wearing of face masks, and handwashing were to be observed.

However, in Kenya, schools lack adequate physical facilities to respond to social distancing. Schools also lack sufficient water points that can mitigate the effects of the virus. According to UNICEF, Kenya (2020), 59 percent of Kenyans

have access to clean water. Sustainable Development Goals numbers 6 and 4 aim at the accessibility of adequate water, sanitation, and hygiene (WASH) facilities in schools. The availability of WASH contributes to an improvement in access to education and learning outcomes (UNICEF, 2018). This implies that quality education and mitigation of COVID-19 cannot be realized in schools in Kenya. It is therefore difficult for schools without water resources to have handwashing facilities. Besides, most schools are understaffed. There is an acute shortage of teachers in Kenyan primary and secondary schools. Kenya, like any other developing country, has a weak economy. Her economy cannot support the provision of masks to all the students. Also, Kenya has not come up with a legal policy on the coronavirus and education. Besides, the Kenya Institute of Curriculum Development (KICD) is mandated to develop a school curriculum. KICD is also required to build curriculum support materials for basic and tertiary education in Kenya. In contrast, there are no curriculum support materials that have been developed for online learning. The only support materials developed are radio and T.V. education programs. The programs are media support materials for learners meant for reinforcement of learning. We are now in a world that requires new approaches to learning.

II. STATEMENT OF THE PROBLEM

Globally, COVID-19 has impacted negatively on all sectors. Kenya has put in place several precautionary measures to mitigate the pandemic in its early stages, including lockdowns and dusk to dawn curfews (Aluga, 2020). The pandemic has affected regular business transactions in Kenya. Schools had to close down in March 2020 and reopen in January 2021. Though students are on vacation, it is not clear whether schools will reopen. Therefore, COVID-19 has ushered in a new era in the schooling system. There is a need for a paradigm shift in the field of education and communication technology. Pedagogy should mitigate the negative impact of COVID-19 on education. Information technology is aimed at promoting learning through the internet. In 2018, the government of Kenya delivered laptops and

tablets to primary schools to enhance digital learning. A few secondary schools are equipped with information and communications technology (I.C.T.) equipment. Despite this, there is a minimal presence of information technology in primary and secondary schools. Therefore, this study investigated the role of information technology in mitigating the negative impact of COVID-19 in primary and secondary schools in Kenya. With the increase in the use of online modalities during COVID-19, it is necessary to assess their effectiveness regarding teaching and learning from various stakeholders.

III. IMPACT OF CORONAVIRUS PANDEMIC

China was the first country to detect COVID-19 disease in the city of Wuhan in December 2019. After that, the disease spread like wildfire. WHO declared the COVID-19 outbreak as a pandemic in March 2020. After that, COVID-19 spread like a Manhattan fire across the world at different levels. As of December 24th, 2020, globally, the pandemic had infected 79.3 million people. 1.745 million patients had succumbed to the disease, and 44.7 million patients had recovered. The United States of America is leading the way with 18.7 million infected cases and 329,000 deaths. India had 10.1 million infected cases and over 147,000 deaths. Brazil had 7.37 million infections and over 172,000 deaths. Russia had 2.91 million reported cases and 51,810 deaths. France reported around 2 million positive cases and over 50,000 deaths. Spain reported over 1 million infected patients and 44,000 deaths.

In Africa, the first COVID-19 cases were reported at the beginning of February 2020. As of December 24th, 2020, Africa had reported over 2 million positive cases of coronavirus. South Africa recorded over 954,000 infected cases and over 25,000 deaths. Besides, Egypt experienced over 130,000 infections, 7,209 deaths, and 108,000 recoveries. Also, Ghana identified 54,043 illnesses, 52,777 recoveries, and over 333 deaths. Similarly, Nigeria confirmed 80,922 disorders, 69,274 recoveries, and 1,236 deaths. Furthermore, Uganda reported 32,399 infections, 10,731 recoveries, and 245 deaths. And Rwanda reported

7,598 illnesses, 6,163 recoveries, and 66 casualties.

The COVID-19 pandemic has overwhelmed advanced health care systems all over the world. Sub-Saharan Africa has been adversely affected by the pandemic because it has weak health and social services. Despite this, sub-Saharan countries acted swiftly to implement travel bans, self-quarantine, ban social gatherings, and close schools. These preventive measures aided sub-Saharan Africa in combating the spread of COVID-19. Economically, various regions were affected to varying degrees by the pandemic. The real gross domestic product growth for the three largest economies (Nigeria, Angola, and South Africa) was projected to fall. The projection was a result of persistently weak growth and investment. The West African Economic and Monetary Union's two economic blocs and the East African Community would also fall. This is due to weak external demand, disruptions to supply chains, and domestic production. Besides, the tourism sector was expected to contract due to travel bans.

A COVID-19 patient in Kenya was first diagnosed on March 13th, 2020, and there has been an upsurge in numbers across the country. Currently, there is a third wave in Kenya. Although the AstraZeneca vaccine has been imported into the country, the new COVID-19 variant is already in Kenya. As of March 2021, Kenya had reported 15,196 confirmed cases of COVID-19. The positivity rate stood at 22%. Patients who succumbed to the disease at this time were 2098. These cases are spread all over the 47 counties of Kenya. This has led to the declaration of the second lockdown in Kenya. The first lockdown was on March 15th, 2020. The pandemic has affected the economic, social, transport, health, and education sectors. Reduced business activities, unemployment rates, traveling, and social gatherings have been restricted. These effects have been felt across all sectors. In Kenya, the field of education has been seriously affected by the outbreak of COVID-19. The school calendar has been interrupted, and over 18 million students are involved.

Primary and secondary school pupils had to be sent home. With the anticipation of third and fourth waves, it is not certain whether regular schooling will persist. As onsite teaching is being interrupted, learners and teachers are unprepared for the new situation. It poses a unique set of challenges in the teaching-learning process.

3.1 The School's Role

School plays a significant role in every person's life and a child's development. School is therefore crucial for the socialization of children. Schools introduce not only fresh concepts to children but also social behaviors for learners. They prepare students to contact other individuals to meet their expectations. The role of school in life is to promote interest and empower individuals to become successful individuals. The expansion of the new education system is similar to the development of our society. It is well established that learning is essential in defining one's personality and coping with life circumstances. Besides, Lavy (2015) notes that contact hours in school promote learning achievement. This is an indication that schools play a crucial role in the linkage of book literacy and experience. A school is a fountain of knowledge for children. It exposes children to the possibility of various fields of education that contribute to increasing learners' thought processes. Besides, schools play a crucial role in human development. Through communication, children are exposed to new ideas. Schools have structures that promote a schooling culture. This implies that children can develop academically and, subsequently, support society. The child is, therefore, able to participate in community services.

School also helps one to appreciate other people's ideas and traditions. They stress an educational culture that promotes math, reading, writing, science, and social studies. Public schools generally follow this educational model, although charter schools can offer a more flexible educational approach. Yann, Cahuc, and Shleifer (2013) were concerned with school teaching practices that affect student beliefs. The concern is in support of progressive education that promotes social capital. Although schools are

crucial in transforming children's lives, there are other options for schooling. Traditional schools' alternatives operate outside the school's jurisdiction. The other options include homeschooling and online learning. Some factors come into play when choosing an alternative school. The components revolve around educational programs, the social environment, and the availability of support services.

Traditional learning was interrupted with the outbreak of COVID-19 in March 2020. The government of Kenya had to adopt a remote and digital mode of learning. Although in 2019, there was a launch of a 24.6 billion laptop project, the gadgets were not supplied to all schools. Besides, they were too expensive and could not bridge digital learning in Kenyan schools. Students don't have smartphones that can be used for online learning. There were also challenges around connectivity and reliable electricity. Remote learning has also faced challenges due to a lack of well-defined infrastructure and equipment. Digital expertise was also a problem. Most of the teachers are digitally illiterate. As a result, there was minimal learning in rural areas and informal urban settlements. There is a need for Kenya to redress these challenges and ensure continued education during the COVID-19 pandemic.

3.2 Protocols for Implementing COVID-19 Curriculum

According to Cahapay (2020), educational systems are likewise preparing for the COVID-19 era characterized by the "new normal." This expression first emerged in the field of business. It was used to caution economists about the beliefs of economists that industrial economies would revert to normal after the recession (El-Evian, 2010). The term has since been used in different contexts to mean that something previously not typical has become typical. It substitutes for the habitual, usual state after a particular event (Platinos and Shinis, 2020).

In the educational dimension, extensive research has discussed the adoption of online modality in instructional implementation in the new normal of the COVID-19 era (Naciri *et al.*, 2020). In

addition, researchers and international organizations have studied the effects of school closures on students' learning and found a measurable loss in acquiring basic skills, particularly for the most disadvantaged children (Quinn *et al.*, 2016; Cattaneo *et al.* 2017). It is on this line that the current study will establish the COVID-19 pandemic and its dramatic long-term effects on students' competencies and increase in educational inequalities.

Before the COVID-19 pandemic, in-school learning had already been proven to be more effective than distance learning. Furthermore, student outcomes resulting from online learning are poorer, on average, than outcomes resulting from face-to-face instruction (Heppen *et al.*, 2017). Conditions for effective remote learning, such as good internet connection, clear explanations, scaffolding, and feedback from teachers, are not easy to achieve. Combining a digital gap with teacher inexperience in providing high-quality distance learning makes it difficult to improve students' learning opportunities. Moreover, there is now a significant risk that vulnerable students have less access to quality teaching than their peers, widening the attainment gap due to the school lockdown (Coe *et al.*, 2020). These emerging discussions regarding education in the new standard COVID-19 era could be reconsidered through the lanes of curriculum implementation. Considering the approaching regular COVID-19 periods, a rethinking of education within the curriculum implementation perspectives is essential. Curriculum implementation should take into account the goal, content, approach, and evaluation. These will inform educators of the critical challenges, decisions, and solutions that must be contently considered as the new era is approached. As COVID-19 brings forth various restrictions, a new standard curriculum may also adopt content integration. This approach gears towards reducing the number of hours spent on all the subjects while still addressing the curriculum expectations. This strategy will enable the assimilation of curriculum content expectations from various topics in designing instruction (Romano *et al.*, 2012).

3.2.1 The Educational Trend of Massive Open Online Courses

UNESCO is a U.N. agency that is mandated to cover all aspects of education. UNESCO advances the idea that education is a human right for all. It further emphasizes access to quality basic education. This has been done through sustainable development goal number four. UNESCO has come up with four trends that are crucial in education. These trends include neuroscience, massive open online courses (MOOCs), Blockchain technology, and population growth. The trend of MOOCs is relevant in mitigating the effects of the coronavirus. Oxford dictionaries online refer to MOOCs as a program offered online at a minimal cost to people who decide to log on to the website and sign up. The proponent of the term "MOOC" is Dave Cormier (Wikipedia, 2015). It described the Connectivism and Connective Knowledge courses delivered by George Siemens and Stephen Downes in 2008. It was an online course that was offered free to over 2000 people. "M" stands for "Massive." A MOOC is massive because it attracts many participants at the same time. For example, the University of Edinburgh's E-learning and Digital Cultures course enrolled over 40,000 students. The participants came from various parts of the world. The potential of Massive Open Online Courses (MOOCs) is being actualized in higher education across the globe (Rambe & Moeti, 2017). This is an indication that it is higher education institutions that operationalize MOOCs.

The first O stands for "open." Learners are drawn from various geographical regions (Rodriguez, 2012). According to Dave Cormier, the MOOC is accessible, and participation is free. The work is shared among all the participants. Hence, it is open to all. This implies that MOOCs do not have prerequisites or tuition fees. The second O is for online. It refers to a mode that is offered through the internet. MOOCs feature a course structure, or the "C" in "MOOC," meaning pre-arranged learning experiences. Grimmelmann (2013) refers to the pre-arranged experiences as a series of checkpoints and deliverables integrated into the instructional design. The design accommodates an expert who transmits pre-defined content to

the learners. The participants then analyze the debate and generate content of their own. The content is also sourced from peers. The trend of MOOCs is the latest in online learning. They are crucial for eLearning professionals who want to keep up-to-date with the latest trends in education. MOOC enrollment grew from 3.6 million in 2012 to 9.7 million in 2013 (NUTN, 2014). This implies that MOOCs can target a large number of learners. However, tracking the target audience is critical. Issues of course management ought to be addressed. Teachers should analyze to facilitate tracking of learners' performance and intervene accordingly. This process generates valuable data that helps facilitators make decisions about the improvement of the course.

In MOOCs, the administrator should consider the instructional strategy to be used. The audience is significant, and the teacher should address the individual learners' needs. Facilitators should apply good pedagogy to MOOCs. The pedagogy offered should be for self-study or instructor-led. Therefore, facilitators should use both synchronous and asynchronous approaches in MOOCs. The strategy will involve online interactive presentations, the sharing of slides, and other resources. Learners should also be allowed to communicate amongst themselves. In light of this, Gillani & Eynon (2014) note that learners are encouraged to participate in discussions to support one another. Failure to interact leads to low completion rates in MOOCs (Lackner & Kopp 2014). Besides, Jordan (2014) revealed that the completion rate was as low as 0.9% in MOOCs. In this respect, interactive activities are critical. Although the strategies of most MOOCs are usually asynchronous, some cases may also include synchronous features, such as interactive live chats. MOOC content usually involves uploading online content of various types, like interactive flash-based presentations. MOOC developers also have the opportunity to upload their videos. This consists of uploading recorded lectures, which can be for MOOCs. Another pedagogical approach that is ideal for MOOCs is constructivism. Constructivism is based on the premise that students are responsible for their learning. Mackatiani et al (2018) applauded these approaches as being learner centered.

Therefore, instructional approaches for MOOCs are based on knowledge gained by doing activities. The activities promote interaction within the MOOC content. Through online activities, the design engages learners in problem-solving and decision-making activities. These activities promote learning.

Assessment is also very critical for MOOCs. The massive aspect of MOOCs has implications in terms of evaluation. For an assessment to be conducted, issues of authentication and proctoring are critical (Sandeem, 2013). It is essential for the person who has completed the course to be assessed. Also, the same person who enrolled in the system should be the one to be evaluated. Formative assessment is crucial for MOOCs. Brief questions offered throughout the course appraise learners. Besides, facilitators keep track of learners' progress on the spot. Facilitators can therefore proceed to remedial action in the form of feedback. Also, the presence of the facilitator can motivate learners and significantly reduce dropout rates. Due to the large number of participants, facilitators should stick to closed-ended questions. The MOOC system can automatically grade these questions. The process allows the MOOC course facilitator more time for other services, such as tracking learners' progress. Besides, the teacher can give feedback on group activities. Also, improvements to the MOOCs can be adjusted accordingly. The other implication is that, being online examinations, they should start and end as stated. After the assessment has been conducted, accreditation has to be considered. However, NUTN (2014) notes that there is no system of credit recognition among MOOC platforms. This implies that examinations administered on MOOC platforms cannot be used for accreditation purposes.

Since the first inception of MOOCs in 2008, accelerated development of the courses has been manifested in research in the higher education sector (McAuley et al., 2010). Research activities and studies were concentrated in the developed economies. In sub-Saharan Africa, enrollment of MOOCs in tertiary education has grown by 8.6% annually over the last four decades (Rambe and Moeti, 2017). With the introduction of the African

Virtual University (A.V.U.) in 2009, dedicated to providing Africans with access to high-quality education through online learning, there was slow progress due to technology constraints. In line with the vision of the African Virtual University and the overall educational objectives, S.S.A. adopted open online courses. The Southern Sub-Saharan countries that have adopted MOOCs include South Africa, Nigeria, Kenya, Rwanda, and Tanzania. This is as a result of the respective government's initiative to invest in education.

In Kenya, Jobe (2013) reported the design and development of quasi-MOOCs as a means of open educational resources and teaching and learning platforms for teachers and students across the educational strata in Kenya (i.e., primary, secondary, and universities). The objectives of the "Kenyan Cloud School" are the contextualization of subjects. To provide each subject taught in the schools in English and Kiswahili through the quasi-MOOCs and strictly adhere to the existing approved secondary curriculum in Kenya Learning. Combining learning aspects from the different MOOC types, such as structured lectures, interaction, and open resources, enhances learning value.

MOOCs use a mixed approach that combines constructivism, social learning, and connectivism to actualize knowledge. Constructivism assumes that students are responsible for their learning. Therefore, the premise is based on understanding by doing activities. During the COVID-19 era, MOOCs were consequently ideal.

3.3.2 The Difficulties of Implementing Massive Open Online Courses

In March 2020, the World Health Organization (WHO) declared COVID-19 a pandemic, posing a contemporary threat to humanity (Olasile & Emrah, 2020). Merriam-Webster Online Dictionary (2020) referred to the pandemic as "an outbreak of a disease that occurs over a wide geographic area and affects an exceptionally high proportion of the population." This pandemic forced the global shutdown of several activities, including the suspension of face-to-face learning. In this regard, there were around 1.6 billion

learners across 194 countries, accounting for more than 90% of total enrolled learners affected by school closures due to the pandemic (UNESCO, 2020). The sudden closure of schools pushed learning institutions to migrate to online platforms to guarantee children's right to education. However, Ribeiro (2020) indicated that the digital transformation of instructional delivery came with several logistical challenges and attitudinal modifications.

School closures produce unequal learning opportunities in formal and non-formal education for children and young people from different socioeconomic backgrounds. In Kenya, during COVID-19, the instructional time received by students from different social backgrounds has been unequal, as has the educational value of the activities developed at home in non-school time. These unequal opportunities, in turn, are likely to exacerbate existing inequalities in skills acquisition and academic performance. School closure, even when distance (remote) learning is offered, usually implies a reduction in instructional time and, consequently, a decline in learning time (World Bank, 2020). Despite the efforts to support remote learning, many students have not had access to it. Existing data about the digital gap and surveys conducted during the lockdown indicate that teachers have been unable to contact a significant number of students (Kuhfeld et al., 2020).

Additionally, financial constraints negatively impact the implementation of e-learning. The government of Kenya has set aside 17 percent of the annual budgetary allocation for education. The funding is inadequate. Huynh et al. (2003) noted that budgetary restrictions are a concern for educational institutions. Therefore, lousy financing of education cannot promote e-learning. As a result, institutions are unable to carry out all necessary e-learning activities. According to ESIB (2014), institutions that offer e-learning must provide adequate technological infrastructure. Thus, for effective e-learning, the availability of computer labs and computers is crucial. Similarly, Kibuku, Ochieng, and Wausi (2020) indicate that the delivery of e-Learning depends on a flourishing I.C.T. infrastructure. Therefore,

e-learning infrastructure is a significant concern in primary and secondary schools in Kenya.

Besides provision of adequate technological infrastructure, network connections and technical support for both students and staff are also important. However, internet bandwidth has hampered e-learning. According to the MoE (2013), bandwidth was \$160 per Mb/s in developing countries. Subsequently, the cost of internet bandwidth is very high for primary and secondary schools. Basic institutions cannot afford to procure adequate internet bandwidth. With this, it has made remote learning close to impossible, especially for marginalized areas. This has further resulted in slack in the implementation of online learning. Stage et al. (2020) point out that the shift to remote learning exacerbated the dropping out of underserved students from online instruction due to lack of bundles, network challenges, and having a caregiver affected by the economic impacts of the COVID-19 pandemic.

On the other hand, operational e-learning policies are crucial in implementing e-learning (Nyerere, 2016). The functional or dysfunctional policy framework determines whether or not e-Learning initiatives will fail or succeed. For example, Catherall (2005) established that schools don't have I.C.T. and e-learning policies of any sort in Kenya. Similarly, the Government of Kenya Sessional Paper of June 2012 on the Policy Framework for Education and Training also admitted that. However, the Sessional Paper No. 1 of 2005 mentioned an e-Learning policy, and such a policy framework was still absent seven years later. However, the 2012 Sessional Paper drew up an e-Learning policy framework to guide practice in the country from the year 2012 onwards as we advance, though these guidelines have largely remained unimplemented at the national level to date. Therefore, e-learning policies are a challenge in basic educational institutions. Furthermore, it appears that the Ministry of Education does not have a clear and operational e-learning policy for both primary and secondary schools.

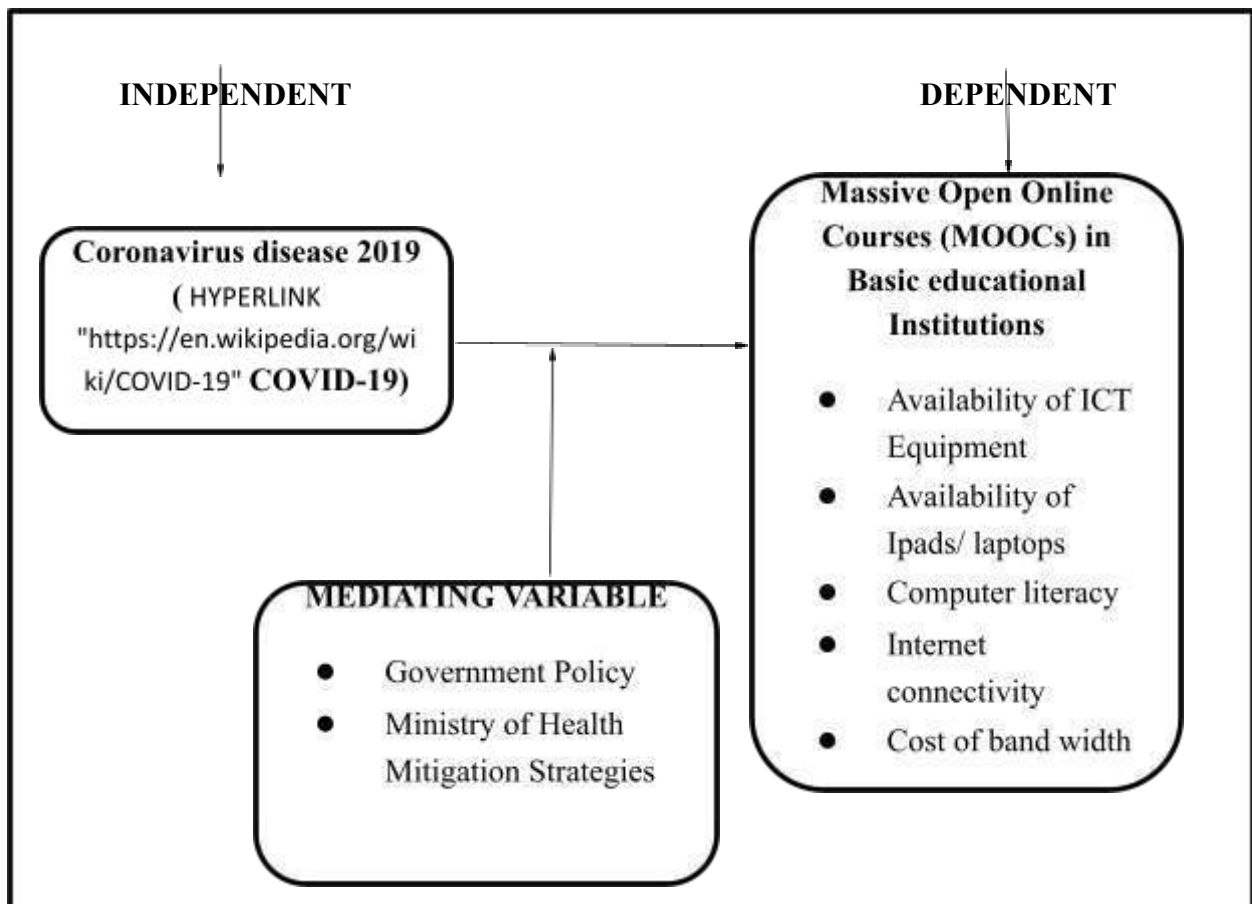
IV. THEORETICAL CONTEXT

The study was guided by e-learning theory built on cognitive science principles that demonstrate how the use and design of educational technology can enhance effective learning (David, 2015). The theory outlines cognitive science principles that describe how electronic educational technology is used and designed to promote effective learning (Sweller, Van Merrinboer & Paas, 2019). Mayer, Sweller, and Moreno (2015) recommend using imagery to convey non-linguistic visual information and simultaneous audio communication for linguistic communication. They advanced that channeling linguistic information through audio while concurrently showing non-text imagery is very effective. The split-attention effect suggests that a single modality should not convey multiple streams of data simultaneously. Therefore, using the audio system for verbal information and the visual design for imagery is more efficient. These cognitive principles apply to e-learning.

The theory is applicable to this study as it suggests combining media to facilitate learning. Therefore, the approach is more effective in e-learning. If these two principles are followed, there is efficiency. The proponents of e-learning revealed that words go better through the ears and images go better through the eyes. Hence, e-learning is more compliant as certain combinations of media facilitate learning more effectively. Besides, e-Learning is not applicable during onsite learning.

V. CONCEPTUAL FRAMEWORK

The researcher conceptualized the independent, dependent, and intervening variables as shown in Figure 1.1



Source: Author (2021)

Figure 1.1

VI. METHODOLOGY

This study adopted a mixed-method approach. The method incorporated both quantitative and qualitative analysis of data. The study's target population included headteachers, teachers, and students in primary and secondary schools in Kakamega County, Kenya. Kakamega County has 12 sub-counties that accommodate 250 secondary schools and 850 primary schools. A target population of 1100 head teachers, 12,000 teachers, and 90,000 students was realized from these schools. Thus, the target population was 913000. The target aimed to access respondents who had information about information technology. The study sampled primary and secondary schools at a ratio of 3:1 per sub-county. The ratio translated to a sample size of 384 respondents (12 secondary headteachers and 36 primary headteachers; 2 teachers (one male and one female per school), leading to 24 teachers in secondary schools and 72 teachers in primary schools; and five students per school (60 secondary students and 180 primary students) was drawn to conform to the confidence interval of 0.05, a confidence level of 1.96, and a standard deviation of 0.5. The study objectives contributed to the collected data. The quantitative and qualitative responses of respondents were analyzed. The data led to the coding of the information that was collected. The coded data was entered and analyzed using the statistical package for social sciences software (SPSS version 20) to analyze the data. Qualitative data was classified according to the study variables (class size, attitudes, and competencies). The Cronbach's alpha test of variable reliability of the relevance coefficient at 0.67 (Virginia University, 2016) was used. Descriptive statistics were summarized into means, regressions, and frequencies. Tables and

graphs were used to present the findings. Regression analysis determined the relationship between the independent variables of information technology and the dependent variable of learning achievement.

VII. THE SIGNIFICANCE OF THE STUDY

The Ministry of Education is committed to the provision of quality, equitable, and inclusive education to all students and learners across the country. The right to education for all Kenyan children is strongly stipulated in the Constitution of Kenya, 2010. However, the Corona Virus Disease in 2019 (COVID-19) has a significant barrier to effective learning across the nation. Therefore, the study might be substantial to Kenya and sub-Saharan Africa as policymakers would use the findings on how to formulate educational policies to redress the impact of the coronavirus on education. In addition, education policy implementers might use the study to actualize e-learning in schools. The study might also contribute to the literature on coronavirus and education and thus be of value to scholars and researchers in comparative and international education.

VIII. RESULTS AND DISCUSSIONS

This study interrogated initiatives that mitigate the impact of COVID-19 on education in basic education institutions in Kenya. The following objectives guided the study: to examine the effects of the coronavirus on education, assess the role of schools, and discuss online initiatives that can mitigate the impact of the coronavirus.

The first objective sought to establish the effect of COVID-19 on education. The study sought the views of the headteachers, teachers, and students. Their perceptions are captured in Table 1.

Table 1 Headteachers', Teachers' and Pupils' Views on Impact of COVID-19

Attendance	Primary schools						Secondary schools					
	head teachers		Teachers		pupils		headteachers		Teachers		Pupils	
	n	%	n	%	n	%	n	%	n	%	n	%
Negative	36	100	72	100	180	100	12	100	96	100	96	100
Positive	0	0	0	0	0	0	0	0	0	0	0	0
Total	36	100	72	100	180	100	12	100	24	100	60	100

The data contained in Table 1.1 revealed that 100 percent of headteachers in primary schools indicated that COVID-19 negatively impacted Education. Another 100 percent of the headteachers in secondary schools showed that COVID-19 negatively impacted Education. Also, 100 percent of teachers in primary schools indicated that COVID-19 negatively impacted Education. Another 100 percent of the teachers in secondary schools showed that COVID-19 negatively impacted Education. Besides, 100 percent of pupils in primary schools indicated that COVID-19 negatively impacted Education. Another 100 percent of students in secondary schools showed that COVID-19 negatively impacted Education.

Further findings from Table 1.1 revealed that none of the headteachers, teachers and students from primary and secondary schools showed that COVID-19 positively impacted Education. Overall, all the respondents noted that COVID-19 negatively impacted Education. This implied that onsite learning had been interrupted.

The second objective sought to assess the role played by schools. To determine the role played in schools, the study sought views from the headteachers and teachers. Their perceptions were captured in Table 1.2

Table 2: Perceptions of Headteachers and Teachers on the Role of Schools

Importance	Primary schools				Secondary schools			
	Head teachers		Teachers		Head teachers		Teachers	
	n	%	n	%	n	%	n	%
Crucial	36	100	72	100	3	100	24	100
Inadequate	0	0	0	0	0	0	0	0
Total	36	100	72	100	12	100	24	100

From the data contained in Table 1.2, 100% (percent) of the headteachers, teachers, and pupils in primary schools indicated that schools play a crucial role. Besides, 100% (percent) of headteachers and students in secondary schools reported that schools play a pivotal role. Further findings from Table 1.2 indicated that none of the respondents said schools don't play a crucial role. Overall, therefore, there was a consensus that schools are essential. This implied that with the closure of schools, learning was not taking place.

The third objective sought to investigate online initiatives that can mitigate the impact of COVID-19.

- The study sought views from the headteachers and teachers on the availability of I.C.T. equipment. Their perceptions were captured in Table 1.3.

Table 3: Perceptions of Head teachers and Teachers on Availability of ICT Equipment

Adequacy	Primary schools				Secondary schools			
	Head teachers		Teachers		Head teachers		Teachers	
	n	%	n	%	n	%	n	%
Adequate	2	5.6	50	17.4	3	25	30	31.3
Inadequate	34	94.4	238	82.6	9	75	66	68.7
Total	36	100	72	100	12	100	24	100

From the data contained in Table 1.3, 5.6% (percent) of the headteachers and 17.4% (percent) of teachers in primary schools indicated that I.C.T. equipment was adequate. However, 25% (percent) of the headteachers and 31.3% (percent) of teachers in secondary schools reported that I.C.T. equipment was sufficient. Further findings from the data in Table 1.3 indicated that 94.4% (percent) of the headteachers and 82.6% (percent) of teachers in primary schools reported that I.C.T. equipment was inadequate. However, 75% (percent) of the headteachers and 68.7% (percent)

of teachers in secondary schools indicated that I.C.T. equipment was insufficient. Overall, therefore, there was inadequate I.C.T. equipment. This implied that online classes are hardly conducted in basic institutions.

- The study also sought to establish the availability of I pads/ laptops to headteachers, teachers, and pupils. The headteachers' teachers' and pupils' responses were reflected in Table 1.4.

Table 4: Perceptions of Head teachers and Teachers on Availability of Ipads/ Laptops

Attendance	Primary schools						Secondary schools					
	head teachers		Teachers		Pupils		head teachers		Teachers		Pupils	
	n	%	n	%	n	%	n	%	n	%	n	%
Available	2	5.6	2	2.7	0	0	9	75	3	12.5	0	0
Not Available	34	94.4	70	97.3	180	100	3	25	21	87.5	60	100
Total	36	100	72	100	180	100	12	100	24	100	60	100

Concerning data in Table 1.4 on availability of Ipads/lab tops, 5.6% (percent) of headteachers in primary schools and 12.5% (percent) of headteachers in secondary schools indicated that they had Ipads/laptops. Besides, 2.7% (percent) of teachers in primary schools and 12.5% (percent) of teachers in secondary schools stated they had Ipads/lab tops. However, none of the pupils in both primary and secondary schools indicated they had Ipads/laptops. Further findings from Table 1.4 revealed that 94.4% (percent) of headteachers in primary schools and 25% (percent) of headteachers in secondary schools noted that they did not have Ipads/laptops. Also,

100% (percent) of teachers in primary schools and 87.5% (percent) of secondary schools indicated they lacked Ipads/laptops. One hundred percent of pupils in both primary and secondary schools lacked Ipads/ laptops. Overall, teachers and pupils in primary schools lacked Ipads/laptops. This implied that due accessibility to e-learning is constrained.

- Further, the study sought headteachers' and teachers' perceptions on whether they are computer literate. Their perceptions were captured in Table 1.5.

Table 5: Headteachers and Teachers' Perceptions on Computer Literacy

Attendance	Primary schools						Secondary schools					
	head teachers		Teachers		Pupils		head teachers		Teachers		Pupils	
	n	%	n	%	n	%	n	%	n	%	n	%
Literate	2	5.6	2	2.7	0	0	9	75	3	12.5	10	16.7
Illiterate	34	94.4	70	97.3	180	100	3	25	21	87.5	50	83.3
Total	36	100	72	100	180	100	12	100	24	100	60	100

Concerning data in Table 1.5, 5.6% (percent) of the headteachers in primary schools and 75% (percent) of headteachers in secondary schools indicated that they were literate. Besides, 2.7% (percent) of teachers in primary schools and 12.5% (percent) of teachers in secondary schools indicated that they were digitally literate. However, 0% (percent) of the pupils in primary schools and 16.7% (percent) of the pupils in secondary schools indicated that they were computer literate. Further findings in Table 1.5 revealed that 94.4% (percent) of the headteachers in primary schools and 25% (percent) of headteachers in secondary schools indicated that they were computer illiterate.

Besides, 97.3% (percent) of teachers in primary schools and 87.5% (percent) of secondary schools indicated that they were digitally illiterate. However, 100% (percent) of the pupils in primary schools and 83.3% (percent) of the pupils in secondary schools indicated computer illiteracy. Overall, teachers and pupils stated that they were computer illiterate. This is an indication that digital competency is crucial in basic education institutions in Kenya.

- The study also sought headteachers' views on challenges facing e-learning. Their perceptions were captured in Table 1.6.

Table 6: Head teachers' Views on E-learning Challenges

Views	Rating			
	Primary		Secondary	
	n	%	n	%
Connectivity	27	75	8	66.7
Cost of band width	27	75	9	75
Infrastructure	27	75	4	33.3
Technical support	27	75	6	50

Concerning data in Table 1.6, 75% (percent) of headteachers in primary schools and 66.7% (percent) of headteachers in secondary schools connectivity was a challenge. In addition, 75% (percent) of headteachers in primary and secondary noted that the cost of bandwidth was a challenge. Further findings from Table 1.6 revealed that 75% (percent) of the headteachers in primary schools and 33.3% (percent) of headteachers revealed that infrastructure was a challenge. Also, 75% (percent) of the headteachers in primary schools and 50% (percent) of the headteachers in secondary schools indicated that

technical support was challenging. Thus, overall, headteachers in primary and secondary schools perceived that connectivity, cost of the band with, infrastructure, and technical support were challenges in implementing e-learning. This was an implication that implementers of MOOCs should be cautious of these aspects when establishing e-learning in schools.

- The study also sought headteachers' consensus of MOOCs in mitigating the impact of COVID-19 on Education. Their perceptions were captured in Table 1.7.

Table 1: Perceptions of Head teachers on Mitigation of COVID-19.

Perceptions	Rating			
	Primary		Secondary	
	n	%	n	%
Strongly agreed	27	75	8	66.7
Agree	9	25	4	33.3

Disagreed	0	0	0	0
Strongly disagreed	0	0	0	0

About data in Table 1.7, that 75% (percent) of headteachers in primary schools and 66.7% (percent) of headteachers in secondary schools agreed that MOOCs are crucial for mitigating the impact of COVID-19 on Education. However, 25% (percent) of headteachers in primary schools and 33.3% (percent) of teachers in secondary schools strongly agreed that information technology is crucial for mitigating COVID-19 on Education. Further, the findings from Table 1.7 revealed that none of the headteachers in primary and secondary schools disagreed that MOOCs are essential for mitigating the impact of COVID-19 on Education. Also, none of the headteachers in both primary and secondary schools strongly disagreed that MOOCs are critical to the effect of

COVID-19 on Education. Overall, headteachers in primary and secondary schools perceived that MOOCs are vital in mitigating the impact of COVID-19. This was an implication that MOOCs should be initiated in Kenyan basic institutions to combat the effects of COVID-19 on Education.

Testing the Hypothesis of the study

The study hypothesis was H.O.: Massive Open Online Courses do not significantly mitigate the impact of COVID-19 on Education. Regression analysis was done to determine the mitigation of the COVID-19 on Education in primary and secondary schools. Results of the investigation were as indicated in Table 1.8.

Table 8: Regression Model on MOOCs

				Change statistic				
R	R Square	Adjusted R Square	Std Error of the Estimate	R Square Change	F Change	df1	df2	Sig F Change
.368	.135	-.345	.531	.135	.282	5	9	.912

- *Predictors:* (Constant); computing labs, I.T. teachers, computers, digital competencies, electricity, connectivity
- *Dependent:* e-learning

Concerning the data contained in Table 1.8, results were summarized by the following regression analysis equation:

$$Y = a + bX;$$

Where Y = dependent value (learning process) that was being predicted in this study. X was the independent value (teaching/learning approaches). The value (a) was the constant in the regression analysis equation. It was the intercept point of the regression line and the Y-axis. The (b) value was the coefficient of X. It was the slope of the regression line. The independent variable for the Hypothesis Ho in the study was Massive Open Online Courses and their influence on the

mitigation of COVID-19 in primary and secondary schools.

The results in Table 1.8 indicated that the significance level was at sig $F = 0.912$. It was greater than $p = 0.05$. The relationship $F(5,9) = 0.282$. $p > 0.05$, adjusted $R^2 = 34.5\%$ (percent). The Hypothesis was, therefore, rejected. This meant that X= MOOCs predicted mitigation of the impact of COVID-19 in primary and secondary schools. The study, therefore, revealed that adoption of the Massive Open Online Courses (MOOCs) predicted the mitigation of the impact of COVID-19 in primary schools by 34.5 % (percent).

IX. MAJOR FINDINGS

The study's findings revealed that schooling is crucial for the development of both social and economic skills. Besides, the study showed that

the coronavirus has negatively impacted education. It was also stated that the available physical facilities and water resources could not mitigate the effects of the coronavirus. The study further established that schools lack essential equipment for Massive Open Online Courses (MOOCs). The findings further revealed that teachers lack digital competency. The study also indicated that connectivity issues were crucial in the implementation of MOOCs. Besides, the study pointed out that connectivity, cost of bandwidth, infrastructure, and technical support were challenges in implementing e-learning. It was further noted that of the four trends in education, online learning could mitigate the effects of the coronavirus. Finally, regression analysis revealed that MOOCs significantly reduce the impact of COVID-19 on education by 34.5 percent.

X. CONCLUSIONS

The study concluded that schools are crucial for social and economic development. It was also concluded that the coronavirus has negatively impacted on education as learning has been interrupted globally. It was further concluded that I.C.T. equipment in basic institutions is inadequate. Besides, it was concluded that teachers lack the necessary competencies to implement e-learning. In addition, it was concluded that connectivity, bandwidth costs, infrastructure, and technical support were challenges in implementing e-learning. Finally, it was concluded that Massive Open Online Courses (MOOCs) could mitigate the impact of COVID-19 on education.

XI. RECOMMENDATIONS

It was recommended that proper structures be put in place to combat COVID-19. Besides, it was suggested that education stakeholders should facilitate schools' acquisition of essential equipment for I.C.T. It was also recommended that in-service education and training (INESETS) be organized for teachers to equip them with digital competencies. It was further suggested that Massive Open Online Courses (MOOCs) be initiated in basic education institutions.

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