

Adoption of Education Technologies for Learning During COVID-19 Pandemic: The Experiences of Marginalized and Vulnerable Learner Populations in Kenya

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Abstract

The onset of COVID-19 made governments and other education actors prioritize distance learning, particularly through education technologies (EdTechs). Most sub-Saharan African countries adopted and adapted this approach. This paper examines the extent of EdTechs' deployment in Kenya during the COVID-19 pandemic among marginalized and vulnerable populations. A cross-sectional study design was adopted for the study from which this paper drew its data, with both secondary and primary data utilized. The findings show that marginalized/vulnerable learner populations are still left out on EdTech supported learning. This article proposes salient recommendations that could help advance inclusive education discussion and related EdTechs' discourse.

Keywords

education technologies (EdTechs), COVID-19, marginalized and vulnerable populations, distance learning solutions, schools' closure, socioeconomic status

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Introduction

Education is undoubtedly a medium of sociocultural, economic, environmental, and political advancement, largely attributed to the hastened globalization and speedy rate of technological advancements (OECD, 2019). The two forces—rapid technological advancements and globalization—have offered varied opportunities (e.g., distance/online learning and informational exchange) for human development in the face of an uncertain future, which we must well prepare for (OECD, 2018). Children who joined learning institutions in 2015 for instance, will be young adults in 2030, and the education systems in place must prepare to offer such learners the much needed relevant and quality skills to help navigate future labor force and technologies, to address future problems (Ngware et al., 2019; Ochieng & Ngware, 2021). This must be a collaborative responsibility involving participation of all education stakeholders (learners, schools, and wider community among others). Provision of the envisioned quality and relevant skills has the propensity to help learners to develop effective inquisitive, self-regulation, imagination, and resilience capabilities; be able to adopt and adapt to adversities, rejection, and failures; and appreciate and respect values, ideas, and perspectives of others, otherwise known as holistic learner development (Awiti et al., 2019; Baah-Boateng, 2016; Bartel, 2018; Ngware et al., 2019).

Key intervention needed to attain the holistic learner development—for social inclusion and economic development—is the revitalization of teaching and learning as well as related platforms to help develop learners and other education stakeholders' capabilities, to take an active role in remaking their communities (Ranson, n.d.). Action and/or practice calls for a provision of inclusive and quality education (Baah-Boateng, 2016; Bartel, 2018). In the above aspects, the role of technology in the education space is undisputed, as the former (technology) is a key enhancer of education on many fronts, including facilitation, improved student engagement and collaboration, utilization across levels of learning, opportunities for practical hands-on learning, and enhancement of learners' confidence levels (Costley, 2014). For this reason, it is imperative that Africa, and in particular, the sub-Saharan African (SSA) region, transforms its education system and embrace technology in education if it must convert its demographic dividend—young population—into knowledge capital that is equipped to offer a sustained quality, relevant, and inclusive education that meets international labor force standards (Yadav, 2016).

Literature Review

Education does prepare learners with an inner sense of purpose as well as the competencies needed to not only guide their lives and wellbeing but also of others (OECD, 2018). Nevertheless, education in Africa and in particular the SSA region is still marred by widespread exclusivity, which hinders the region's capability to compete favorably with other regions in the global labor force competition arena (Awiti et al., 2019;

Yadav, 2016). For instance, more than one-fifth of children aged between 6 and 11 are out of school, with another one-third of youth aged between 12 and 14 out of school (UNESCO & UIS, 2020a). Overall, about 60% of youth aged between 15 and 17 are out of school in SSA (UNESCO & UIS, 2020a). The high out of school rates are attributed to educational challenges that compound the SSA education systems, including lack of or inadequate basic amenities such as water, electricity, financial resources, assistive devices and personnel for learners with special needs, classrooms, textbooks, and teachers among others (Ngware & Ochieng, 2020, 2021). In fact, evidence indicates that in 10 countries, seven countries are facing acute teacher shortages (UNESCO & UIS, 2020b), which further exacerbates issues to do with quality teaching and learning.

In terms of gender, girls' education has become a major priority in the SSA region due to their widespread exclusion in access to and transition through the education space (Di-Marco, 2016; UNESCO & UIS, 2020c; UNICEF, 2019). For instance, 9 million girls aged between 6 and 11 will never attend school, compared to 6 million boys in the same age bracket (UNESCO & UIS, 2020c). This exclusion or bias begins in the early educational stages, considering that 23% of girls are out of primary school compared to 19% for boys. This remains consistent through to adolescent/secondary-level learning where 36% of girls and 32% of boys are out of school (UNESCO & UIS, 2020c). Key education stakeholders (e.g., governments, nongovernmental organizations, civil society groups, donors, etc.) must, therefore, urgently step in to remedy the situation. This is because if the current situation in the education sphere is left as it is, it will likely worsen considering the increasing demand for education among the growing school-age population in the region.

The above situation is a replication of in-country-specific situations. For instance, in Kenya, girls' enrolment in schools is 10% lower than boys with a corresponding lower learning attainment of 5% lower than that of boys, hence entrenching gender parity situation in the country's learning outcomes (Di-Marco, 2016; Nokia et al., 2019). Moreover, evidence indicates that marginalized areas that are mostly found in arid-and-semi arid lands (ASALs) and occupying northern and northeastern parts of Kenya have about 61% of its 7- to 13-year-olds exhibiting poor learning outcomes and unable to solve basic literacy and numeracy assignments (Nokia et al., 2019). Learners with special needs even face major difficulties and marginalization in access to education as about 90% of them are estimated to be out of school due to stigmatization, inadequate equipment for learning at home or at school, inadequacies within the existing curriculum, and lack of and/or inadequate teachers trained on special needs' issues among others (Kenya Institute of Special Education, 2018; Nokia et al., 2019).

Exclusion and/or marginalization in access to education and education-related resources is, however, not limited to gender as exclusion occurs both due to learners' socioeconomic status (SES), geographical locations (distance from the source of education/educational capital), and in/availability or in/access to critical infrastructure

(e.g., internet, electricity, roads, etc.) (OECD netFWD, 2019; UNICEF, 2019). For this reason, it is important that in addressing issues relating to out of school children and gendered learning, education actors—governmental and nongovernmental—must address them wholesomely and not in isolation as they are mutually reinforcing (UNESCO & UIS, 2020c).

Currently, the world is grappling with the effects of COVID-19 pandemic—an external shock that has affected all sectors of the human sphere, including the education sector. In Kenya, when the first case of COVID-19 was reported on March 13, 2020 (Tyce, 2020), key policy decisions were made as responses to education provisioning in the country. For instance, like most countries globally, Kenya closed all its learning institutions (on the week of March 16, 2020) including all forms of public congregation (Parsitau & Jepkemei, 2020). Globally, a staggering 1.576 billion learners, constituting over 91% of total enrolment were not been in school. In Kenya, close to 20 million learners (3.2 million preprimary learners, 15 million primary and secondary learners (Ministry of Education, 2020), and over 1 million learners in postsecondary institutions in Kenya were out of school (UNESCO, 2020a). As a result, key education stakeholders (government, learners, parents, and guardians) adopted and adapted varied alternative forms of learning to keep learners engaged in teaching and learning activities during the pandemic (Hodges et al., 2020; Ngware & Ochieng, 2020; Zubillaga & Cortazar, 2020). One key alternative form of learning that was embraced in Kenya during the COVID-19 instigated school closures is the distance learning solution (DLS)/digital learning, also referred to as education technologies (EdTechs) (Government of Kenya, 2020; Ngware & Ochieng, 2020).

In the above alternative, the Kenyan Government together with its education partners (private players, international or national nongovernmental organizations, civil society organizations), adopted and adapted varied forms of distance learning solutions/education technologies to promote distance learning (ADEA et al., 2021; EdTech Hub, 2020). Some of the adopted and adapted EdTechs included radio, television (TV), and internet-enabled platforms such as smart-TV, tablets/computers/laptops, and smartphones, with the latter (internet-enabled platforms), majorly using the YouTube and Facebook recorded and livestream lessons (Government of Kenya, 2020; Ngware & Ochieng, 2020, 2021). Consequently, varied EdTechs were widely used by different users for learning and teaching depending on what was available for each user at individual, household, and/or community level (ADEA et al., 2021; EdTech Hub, 2020).

It is important to note that the adoption and adaptation of EdTechs into teaching and learning practice during the COVID-19 necessitated teachers' capacity building on the use of the different EdTechs for distant teaching in most SSA countries (ADEA et al., 2021; Fitzpatrick et al., 2020). This was particularly after discovering that a significant proportion of teachers in most SSA countries were lacking information and communication technologies (ICT) skills needed to navigate the available and adopted EdTechs for teaching and learning (EdTech Hub, 2020; Mccrocklin, 2019; Ngware & Ochieng, 2020). This situation necessitated the governments to institute

capacity-building measures to develop teachers' capacities on the utilization of key digital technologies/ICT for teaching and learner monitoring (ADEA et al., 2021; McCrocklin, 2019). Further evidence indicated that teaching and learning were not only hampered by teachers' inadequacies but also learners' inability to access and use EdTechs for learning at individual, household, and community levels (Ashlee et al., 2020; EdTech Hub, 2020; Kenya National Bureau of Statistics, 2017, 2018). Against the above background, it is important to understand the extent to which the mentioned EdTechs were available for learners' access and use for learning, and the extent to which such alternative teaching and learning platforms (DLS) were reaching learners, especially to the traditionally marginalized and vulnerable populations. This article sheds light on this aspect with a specific focus on Kenya. In addition, the paper contributes to the understanding of whether EdTechs contribute to reducing the learning inequality gap or furthering the same.

Objectives

The following objectives guided this paper. This paper thus sought to:

- (I) Examine EdTechs in place for continued/distance learning in Kenya.
- (II) Understand the experiences of vulnerable and marginalized learner categories in using the available/existing EdTechs.
- (III) Determine the status of access to EdTechs for learning among marginalized/vulnerable learner populations during the COVID-19 period.
- (IV) Understand how learners with special needs were taught using EdTechs during the school closure period.
- (V) Determine the effectiveness of EdTechs/digital learning in terms of access and use among marginalized/vulnerable learner populations during the COVID-19 period.

Research Question

This paper answers the following research questions:

- (I) What EdTechs were in place for continued/distance learning in Kenya?
- (II) What were the experiences of vulnerable and marginalized learner categories in using the available/existing EdTechs in Kenya?
- (III) What was the status of access to EdTechs for learning among marginalized/vulnerable learner populations during the COVID-19 period in Kenya?
- (IV) How were learners with special needs taught using EdTechs during the school closure period in Kenya?
- (V) How effective were the existing EdTechs/digital learning platforms in terms of access and use among marginalized/vulnerable learner populations during the COVID-19 period?

Methodology

Data Collection

The study relied on both primary and secondary data. For secondary data, a desk review was used to gather data and/or information. The existing secondary data and/or information was synthesized systematically, with the adduced evidence used to inform or understand how or experiences of vulnerable and/or marginalized population in accessing and using digital learning platforms/EdTechs in place for teaching and learning.

In search of the secondary data/evidence, we adopted a scoping review approach in collecting existing information and/or data from reputable and relevant data sources/databases. This was to help us obtain sufficient data and information for the production of succinct, relevant, clear, and laconic findings. In total, eight education-oriented databases were visited including ERIC, Google Scholar, Research Gate, Education Research Complete, Academic Search Premier, SpringerLink, JSTOR, and PsycINFOR among other grey literature information sources.

The following keywords guided our search and formed part of the inclusion criteria: “education technology” + “learning,” “education technology” + “poor and remote learners,” “education technologies or Edu Tech” + “Africa,” “COVID-19” + “digital learning,” “COVID-19” + “digital AND distance learning solutions,” “EdTechs” + “distance learning” + “EdTechs,” “inclusive education” + “Education Technologies” + “Kenya” + “Africa,” “education technologies + poor and marginalized learners + inclusive education,” and “education technologies” + “education for all in Africa” among others. All documents that emerged but did not contain any of the above search terms were automatically excluded. Additionally, other inclusion criteria were that the documents were to be education-related, and universal, meaning that the documents should not be limited to Africa but also those with information on the global practice pertaining to EdTechs and marginalized learner populations. The reverse of the captured inclusion criteria formed the exclusion criteria. The article also relied on primary qualitative data that was gathered concurrently from key education officials in the decision-making agencies using KIIs to shed light on respondents’ perceptions of the study topic. The qualitative data used herein were those obtained from a larger study conducted in the third quarter of 2020 that sought to understand the efficacy of EdTechs for teaching and learning in the Kenyan education landscape. The study of reference (larger study) focused on learners’ access, utility, and capabilities in utilizing existing EdTechs for learning.

Management of Primary Data Collection

Qualitative data (primary data) that informs this article was collected from key informants using a semistructured key informant interview (KII) guide. The interviewees were purposively sampled, with interviews administered in English, which was the respondents’ preferred language of communication. All interviews were audio-recorded and transcribed verbatim by an experienced transcriber. The transcriber

was well versed with the study's objectives and was equally guided by an experienced researcher who took part in the study design and initial conceptualization.

Prior to data collection, the (EdTech) study protocol was submitted to African Population and Health Research Center's internal Research Ethics Committee for review to determine if the study met and adhered to the internationally set requirements for undertaking research among human subjects, including observance of aspects integrity, voluntary participation, and respect of respondents. Once the protocol was approved internally, we submitted it to the African Medical and Research Foundation's Ethical and Scientific Review Committee for external review and consequent approval. In addition, we obtained approval from the National Commission for Science, Technology, and Innovation, which gave the study the green light, including buy-in from targeted key informants. Both the study permit and ethical approval were valid for a period of one year, which was the study's implementation period. Informed consent was administered to the identified participants who voluntarily accepted to participate in the study. Interviewers respected the respondents' right to privacy and opinion, working only with the timing and respondents' preferred convenient settings/environment, away from privacy breaches and related interruptions. The interviewers explained to the interviewees the likely benefits and risks of their involvement in the study in a clear and detailed manner in English.

Data Analysis

Qualitative data were analyzed following a developed coding scheme, informed by emerging themes from the transcripts. Primary coding of the transcripts was undertaken using NVIVO version 12. Meta-codes and themes that emerged were identified, with a particular focus paid to salient diversity and contradiction of views. Such views informed the study's findings.

Practically, the collected qualitative data were transcribed verbatim, and focus was put on the responses that corresponded to the paper's overarching research question. An inductive coding approach was adopted for the analysis of the paper's qualitative data, indicating that coding was data driven. Thus, the derived themes were consistent with information obtained from the respondents'/participants' responses. The responses (qualitative data) were then assigned to suitable codes. We thereafter, reread through the data/responses individually to identify themes that appeared identical and assigned them to the initial set of codes. This exercise was a thorough process that followed a line-by-line reading approach for all the datasets (KIIs) to enable us to derive even more comprehensive codes. The process was repeated by the two authors to help highlight responses that were not assigned the right codes and categorize them in the most suitable codes. Final codes were then categorized in best-fit themes to ascertain and ensure that they fit within the correct theme in our coding frame.

Thematic analysis was also undertaken to help identify the responses that were most common and congruent to the paper's research question, which was then used to write the paper's findings. The adopted thematic analysis was instrumental in assisting the

authors to understand the different respondents' viewpoints, including underscoring the themes dis/similarities as pertains to the paper's objectives and research questions (Braun & Clarke, 2006). Thematic analysis was also instrumental in the development of a concise code sheet as well as a dataset that enabled us to come up with a well-structured and vibrant data report (King, 2004). The derived data were then inferred along with the paper's synthesized literature and research question.

Findings

EdTechs in Place for Continued/Distance Learning and Stakeholder(s) Experiences

While physical schools' attendance remained suspended, learning continued albeit virtually. Both public and private enterprises embraced the use of EdTechs to continue teaching and learning via online and/or digital learning solutions though with varying levels, depending on capacities (Government of Kenya, 2020; Otieno & Taddese, 2020). The key EdTechs adopted for offsite learning during the COVID-19 pandemic when schools are closed include; (i) TV, (ii) Radio, (iii) YouTube, (iv) Kenya Education Clouds, (v) Internet-based platforms/Apps such as Zoom, Blue Jeans, WhatsApp, and Google Classrooms among others (Kenya Institute of Curriculum Development, 2020; Ngware & Ochieng, 2020, 2021; Otieno & Taddese, 2020). The above EdTechs were perceived as platforms that could be used to continue teaching and learning at home seamlessly. All it need was that the teaching and learning stakeholders—teachers, students, and parents/guardians—had to have access to one or more of the above-stated EdTechs at their disposal.

Evidence from the qualitative findings indicates that education stakeholders, particularly the educators, are using EdTechs to continue teaching in the comfort of their homes. EdTechs such as zoom and Google classrooms have particularly been embraced by educators to teach and bring real-time or physical-like teaching experiences to learners' homes. In fact, to well-endowed schools such as high-end private schools with efficient infrastructural systems prefer EdTechs learning approach to onsite learning. This is because the online approach is perceived to be inherently devoid of disruptions and distractions associated with onsite or physical classroom teaching and learning. Put into perspective, a principal from a high-end private school posited that offsite learning is more effective than onsite/classroom learning:

R1: ...online platform like Google Classrooms and Zoom work and personally, they are even more effective than ordinary classrooms...I have managed to finish revising one of the set books...I have marked 6 compositions and returned...and I have moved the average class attendance to 73% from 40%...[#R3]

For institutions and learning stakeholders who are not attending high-end private schools. The above experience is impractical, considering the inherent limitations in

their learning discourse insofar as learning through EdTechs is concerned. Such limitations include unreliable electricity connectivity since most of the EdTechs rely on electrical power to function, yet a huge proportion of learners hail from rural and remote areas that are largely marginalized and have no electricity and internet connection (McCrocklin, 2019). Worse still, learners from marginalized areas may come from households that do not own or have access to any electrical or digital device that aids in virtual learning (McCrocklin, 2019). In fact, such households fall in the bottom quintile in which <12% have no functional TV (Kenya National Bureau of Statistic, 2020a; McCrocklin, 2019). Cost implications associated with owning, using, and maintaining the EdTechs used in virtual learning are another limitation. Poor households would rather buy food for the family than buy internet/data bundles for learning. Learners from such households have thus been disproportionately disadvantaged in terms of access and use of EdTechs. According to Kenya's child poverty indices, around 6.1 million primary and secondary students experience food poverty, and 2.5 million of them hail from the nine poorest counties (Kenya National Bureau of Statistic, 2017). This means that even the most considered basic commodity—food—is a challenge to get, relegating educational pursuits to even distant optional pursuits for poor and marginalized populations.

Even where households are able and willing to buy EdTechs aiding devices or internet for learning, they were limited by lacking or inadequate internet infrastructure such as internet service providers and internet-enabled electronic gadgets, which is consistent with findings from a previous study that highlighted the marked disparities in access to internet connectivity and related infrastructure in most African countries (McCrocklin, 2019). This is a practical experience for most households from poor and marginalized areas. This is a setback that has bedeviled the EdTechs' initiative in promoting education across-board, as it benefits mostly the well-to-do and those in regions that are well served by EdTechs aiding services and infrastructure. Marginalized areas, especially remote and poor areas, are less benefiting from virtual learning that is advanced through EdTechs' platforms (Ahmadzai et al., 2020). Hence, in using EdTechs, learners from marginalized areas are further marginalized in educational pursuit leading to the questioning of the efficiency and effectiveness of EdTechs in promoting equity, equality, and inclusivity in education.

R: ... some of the people here [the region] are able to buy those smartphones, computers and internet but the problem is where they going to get the services like reliable internet or electricity from? ... You know those devices must use electricity or power... we don't have such supportive infrastructures in our areas... [#R5]

Another limitation that emerged from the respondents' experiences with EdTechs was that the use of EdTechs came with its own usage challenges, especially among educators. Some educators had difficulties in navigating the various EdTechs at their disposal to offer teaching and learning materials to learners. This limited teacher capacities to use EdTechs for teaching, further worsened the experiences of learners from

poor and marginalized areas, considering that such educators are mainly in schools serving the poor and marginalized learner-communities (Nokia et al., 2019). This calls for a comprehensive teacher-capacity building initiative in using EdTechs for teaching and learning. The below key informant experience shed light:

R: ...the use of EdTechs made learning difficult for some of our students who are being taught by teachers who were not familiar or do not know how to use ICT properly [#R1]

The government through the Teachers Service Commission having realized this shortcoming initiated the training of 150,000 head teachers, their deputies, and teachers on the use of EdTechs for teaching. This initiative was proposed to begin on July 1, 2020, and end on December 31, 2020 (ADEA et al., 2021; Charo, 2020).

Experiences of Marginalized and Vulnerable Learner Categories

In Kenya, children with special needs, those in remote areas, and girls are often vulnerable and/or marginalized. Preexisting cultural practices—such as female genital mutilation and early marriages—limit girls from marginalized areas and poor households from accessing existing educational options (Di-Marco, 2016; Ministry of Education, 2017; Parsitau & Jepkemei, 2020). Most communities that embrace such practices do not place any importance on girls' education, but the immediate gains associated with early marriages, which is livestock given as dowry (Di-Marco, 2016; Ruto et al., 2009). Poverty at the household level, inadequate education resources at the school level (e.g. for learners with special needs), low education rates within the communities, long distances to school, and poor communication and inexistent social or societal role models from marginalized and poor areas are other factors that contribute to the vulnerability of girls and learners with special needs (Government of Kenya, 2012, 2019). Today, with the threatening COVID-19 pandemic situation, efforts have been refocused to public health interventions that limit the spread of the virus and this means that the mentioned factors will continue to prevail among communities practicing such cultures on their vulnerable populations (Parsitau & Jepkemei, 2020). This means that education pursuit and related outcomes will still be low and will continue to receive little attention from such communities. Communities living in high-poverty areas, ethnic minorities, and the nomadic population also constitute a vulnerable population and are inadequately covered in any education intervention, including EdTechs, during this pandemic period.

“R...some of the cultural practices practiced in some areas, especially those in remote areas do not favor girls' education. For instance, when boys are allowed to go to school, girls are often forced to stay at home and help with household chores...those with special needs are even more lacking in education space because the areas [marginalized] are hardship areas, and children with disabilities are even seen as more burden and their education is not prioritized...”[#R2]

Even before COVID-19, inequality existed in education access and usage. This is observable in the low girls' net enrolment in secondary schools in urban slums, at below 50% (Ministry of Education, 2016). By 2017, around 7% and 22%¹ of primary-school-age children without special needs and with special needs were out of school, with girls in both groups being most affected (Kenya Institute of Special Education, 2018). This is an indication that girls and learners with special needs were most disadvantaged when it comes to access to and transition through every stage of education. This implies that any intervention geared at promoting educational access for learners will automatically disadvantage these segments of learners. Nomadic communities, largely occupying northern and eastern parts of Kenya also record low net enrolments, ranging from 27% to 77% against a national average of 91% (Ministry of Education, 2016). Again, these statistics illustrate prevailing inequalities that can be transcended or extended during and post COVID-19 phase. A qualitative feedback below offers support:

R: ...for nomadic communities like ours, that digital learning is not working...we can only benefit from it if we put these nomadic children in cluster classrooms...so if it was me, I would put clusters at the grassroots and provide solar systems because the sun is in plenty in these areas to improve on access to the electricity that internet can utilize for EdTech or what-have-you...the clusters can be used to provide centralized digital learning in remote areas, but now it is not happening so the system is only benefiting the rich or rich families now...[#R5]

Status of Access to Learning Among Marginalized/Vulnerable Learners During COVID-19

In the study from which this paper draws its data, we determined the proportion of vulnerable children by child poverty² index developed by the Kenya National Bureau of Statistics from the 2019 Population and Housing Census as well as the 2015/16 Kenya Integrated Household Budget Survey (Ngware & Ochieng, 2020). Data for boys and girls aged 6–18³ years in primary and secondary schools in Kenya in 2020 is captured in Table 1 (Kenya National Bureau of Statistics, 2017, 2018, 2020a). Grounding our projection on the incidence of child poverty at the county level, these marginalized and vulnerable learners have low opportunities to access EdTechs, given that they come from very poor households. This is also in recognition of the fact that children in the bottom 40% counties (quintiles 1 and 2) of poverty ranking would be most affected. With high-poverty incidences in counties in quintiles 1 and 2, phone ownership at an individual level range between 27% and 45%, 38% and 54% for function radio, and 13% and 33% for TV, respectively (Kenya National Bureau of Statistics, 2017, 2018, 2020a).

The study's key informants confirmed that learners from marginalized and poor households are undergoing serious learning challenges, worsened by the COVID-19

Table 1. Number and Proportion of Primary and Secondary School Children Aged 6–18 Years at Risk of not Being Reached by Distance Learning Solutions in Kenya.

Quintile using child poverty index	No. of counties	As a proportion of boys enrolled within the quintile (%)		As a proportion of girls enrolled within the quintile (%)		Total	As a proportion of total enrolment within the quintile (%)
		Boys	Boys	Girls	Girls		
First quintile (poorest)	9	497,414	74	445,334	73	942,851	73
Second quintile	10	802,168	52	777,028	52	1,579,182	52
Third quintile	10	820,405	42	806,785	42	1,627,183	42
Fourth quintile	9	500,667	37	485,626	37	986,289	37
Fifth quintile (least poor)	9	489,387	27	486,248	27	975,631	27
Total	47	3,110,041	42	3,001,019	42	6,111,137	42

Note: Estimate from a total number of children aged 5–17 in 2019, gross enrolment in primary and secondary in 2019, and the child poverty index (headcount) from 2015/16 survey integrated household budgetary survey.

situation that forced learners to rely on technology/digital platforms to learn. Significant rural areas in Kenya do not have internet, while in some, it is at a minimal level. This situation makes learning through EdTechs a challenge if not non-existent. At best, such learners can only depend on radios and TV to receive transmitted teaching and learning materials. Still, this does not cover all learners from such areas because ownership of radios and TVs is not uniform across regions, and only benefit learners with access to radios and TVs:

R: It has been a challenge for learners from remote, poor and marginalized areas where internet or network is a problem...it makes them to rely only on television and radio lessons but miss out on internet-based lessons [#R1].

R: ...for learners from rural areas that are mostly marginalized like north eastern Kenya, our children are suffering because they miss out on teaching done online. Even for other areas, households do not own radios or televisions because of poverty. How do their children learn? Nothing...it is not happening for the poor and marginalized [#R2]

How Learners with Special Needs are Taught Using EdTech During the Schools' Closure Period

Existing data indicate that around 90,000 children have hearing or visual challenges in Kenya (Kenya Institute of Special Education, 2018; Kenya National Bureau of Statistics, 2020a, 2020b) and are at risk of missing out on learning provided through the various EdTechs. This gap is attributed to factors such as EdTechs not being inclusive or inexistent at the households' level. We were cognizant of the existence of numerous types of disabilities but due to the inexistence of data in those categories of special needs, we focused on visual and hearing disabilities that had data. It is important to recognize that other special need categories exist including the physically challenged, those with communication and cognition challenges, the deafblind,⁴ and those who need self-care (Government of Kenya, 2009).

In the Kenyan context, learners with special needs are either enrolled in special units and integrated schools or special schools (Adoyo, 2007; Government of Kenya, 2009; Kenya Institute of Special Education, 2018; Moyi, 2017). Special units and integrated schools are established within the normal primary and secondary schools while special schools are separate institutions. In most cases, these institutions need special needs' assistive devices such as radiofrequency systems and group hearing aids for learners with hearing challenges as well as teachers trained on sign language interpretation (Ngware & Ochieng, 2020, 2021). For the visually challenged, braille is essential for their learning (Ngware & Ochieng, 2020, 2021). A key concern is that while these assistive learning devices and personnel may be available in certain schools, their availability at the household level is not guaranteed hence making learning for this category of learners untenable, especially during the school closure period. Children with hearing challenges found it difficult communicating with hearing

parents or other family members during the school closure period as most of these learners if not all, left their assistive learning/communication devices at school and hence could not get interpretation aids for family-assisted learning/communication. Moreover, such devices attract prohibitive costs that most families, especially the poor and marginalized families—could not acquire (Kenya Institute of Special Education, 2018; Moyi, 2017). This means that learners with special needs continue to be left out in learning, a situation worsened by the COVID-19 pandemic.

R...for these learners, teachers teaching them use assistive technologies like braille, sign language or something like radio frequency...but when school closed, these learners seemed to be more detached from their teachers because they needed special attention and close supervision that could not be offered with school closures because the devices in schools were left in schools...most of the time it was up to the parent to help in the support them... [#R1]

There were, however, TV channels that aired teaching and learning programs, both recorded and real-time that were accompanied by sign language interpretation. For instance, the EDU TV Channel aired educational programs live and through its YouTube Channel, with all programs accompanied by sign language interpretation giving special needs learners opportunities to interact and learn through TV devices or internet to learn. However, learners with both visual and hearing challenges (deaf-blind) found it difficult to participate in these educational programs. This means that learners with special needs are in more ways disadvantaged in terms of access and use of EdTechs for teaching and learning, consequently widening the already existing learning inequalities in the education space.

The Effectiveness of EdTech/Digital Learning in Terms of Use and Access

The effectiveness of EdTechs is only plausible as it is capable to promote an all-inclusive learning for all categories of learners. Evidence indicates that while EdTechs adopted for offsite learning during this COVID-19 period are playing a critical role in enhancing and continuing learning, it leaves out a large segment of the

Table 2. School Children Living with Disabilities.

Type of disability	Boys	Girls	Total	Enrolment rate among CWD (%)	Prevalence of disability within the population (%)
Visual impairment	26,130	34,293	60,423	88.9	0.71
Hearing impairment	13,475	16,046	29,521	85.8	0.32
Total	39,605	50,339	89,944	87.9	1.03

Note. We estimated the numbers of school boys and girls with visual and hearing impairment based on disability and enrolment prevalence rates at the national levels. CWD = children with disability.

Table 3. Prevalence (%) of Technology That Could be Used for Distance Learning Among Households.

Quintile using child poverty index	Standalone radio	Functional TV ^a	Internet
First quintile (poorest)	38.8	13.4	5.1
Second quintile	53.5	32.6	14.0
Third quintile	59.9	35.5	13.1
Fourth quintile	61.4	37.3	13.4
Fifth quintile (least poor)	59.4	56.4	28.4
All quintiles	56.9	40.7	17.9

Note. ^aFunctional TV refers to TV that can receive signals. They include TV with free-to-air set-top box/digital TV, TV with Pay-TV decoder, and Internet Protocol TV (KNBS, 2019).

population. As observed earlier, learners from poor households—rural and urban, remote and marginalized areas—are not benefitting from teaching and learning opportunities availed through EdTechs' platforms. The low prevalence of EdTechs, especially among the poor quintiles (see Table 3) indicates that this alternative form of learning only works effectively and efficiently for well-to-do families that have access to one or more of the learning EdTechs.

This is a position equally held by a key informant who opined that:

R: EdTech or digital media, is working well in towns and for the rich homes and rich counties but not in poor and remote areas...where parents even lack smartphones, let alone television or internet... (#R4)

Poverty, however, remains a key obstacle in access to and use of EdTechs among learners from regions and/or households from marginalized, poor, or remote areas (Espino-Díaz et al., 2020). Indicative statistics in Kenya point out that up to 48% of those who earn daily wages live below the poverty line, while another 40% living above the poverty line are at very high risk of falling below the poverty line due to socio-economic shocks such as the COVID-19 pandemic (Kenya Human Rights Commission, 2020). As a measure aimed at insulating the workforce, especially the salaried employees, a number of tax waivers were advanced to this category of workers, despite forming only 20% of the population (Kenya Human Rights Commission, 2020). Worse still, this population was threatened by layoffs and redundancies if the effects of COVID-19 remained the same or worse. Among the poor population categories, the government protective interventions against COVID-19 shocks were largely silent when it came to cushioning special segments such as special needs persons, girls/women, prisoners, refugees, the elderly, and the stateless persons (Kenya Human Rights Commission, 2020). This situation contributed to inability to access and use EdTechs' interventions for this population segment. It is a position that further widens preexisting inequalities inherent in educational access, utilization, and transition among varied educational stakeholders.

Discussion

The effects of school closures were adverse in low- and middle-income countries since this measure further exacerbated the already dire education development indicators in these countries (Espino-Díaz et al., 2020; UNESCO, 2020b). For instance, learning disruptions and related food insecurities attributed to COVID-19 school closures are challenges that were previously experienced in some SSA countries largely due to perennial internal conflicts (Espino-Díaz et al., 2020; Sanz et al., 2020). Other factors common in low- and middle-income countries that were worsened by the school closures include inadequate access to ICT, limited or lack of childcare, poor parental knowledge on use of distance learning solutions, unemployment, increased economic pressure, and increased possibilities of school drop-outs (Espino-Díaz et al., 2020). This is similar to an earlier observation made by the Organization of Ibero-American States for Education, Science, and Culture, which investigated the effects of closure of higher education institutions on learning time (Wößmann, 2003). Consequently, studies (Espino-Díaz et al., 2020; Jaume & Willén, 2019; OECD, 2018; Ranson, n.d.) on this aspect have affirmed that school closures do reduce education time, further worsening missed learning time caused by other human and natural induced calamities/disasters. Espino-Díaz et al. (2020) for instance found that a 10% reduction in education time has a corresponding teaching reduction by 1.5% of the standard deviation. However, studies have shown that even with the interruption of face-to-face teaching, learning, and teaching can still go uninterrupted if education stakeholders, including education institutions, adopt effective ICT for teaching and learning (Furió et al., 2015; Means et al., 2010).

This explains why a significant number of countries globally adopted the use of diverse distance learning solutions (EdTechs) as an alternative to face-to-face teaching and learning for various groups of learners (Coflan & Kaye, 2020; Huang et al., 2020). For instance, Colombia adopted a multichannel approach involving radio broadcasters and public TV as well as WhatsApp, smartphones, and emails for constant monitoring of learners' wellbeing as well as for the administration of teaching exercises and exams. In the Netherlands and Spain, the government issued laptops to those households without to ensure learners from such households take part in distance learning. United Arab Emirates also maintained a well-functioning communication system—the Dubai Mobile app—which was not limited to learners only but all users with the ability to use the app that supported up to 160 services ranging from education, health, and other utilities (United Cities and Local Governments et al., 2020).

In Africa, and SSA in particular, varied distance learning solutions (EdTechs) were utilized to ensure learning remained uninterrupted. Diverse EdTechs were utilized across SSA countries including smartphones, internet-enabled media (e.g., Google classrooms, Zoom, Blue Jeans, WhatsApp, email, and YouTube), radios, TV, and computers/laptops among others in Kenya (Kenya Institute of Curriculum Development, 2020; Ngware & Ochieng, 2020; Otieno & Taddese, 2020), Rwanda (Carter et al., 2020), Ghana (Agbe & Sefa-Nyarko, 2020), and Nigeria (Akogun et al., 2020). The

adopted EdTechs were perhaps due to the perceived confidence in their capabilities in delivering teaching and learning to learners as they were deemed to be accessible to both teachers and learners (Dhawan, 2020).

The reality, however, is that accessibility of this digital infrastructure is limited, especially for learners from the marginalized areas as well as the vulnerable populations such as girls and learners with special needs (Ngware & Ochieng, 2020), further entrenching social exclusion that is widely observed in most education systems (United Cities and Local Governments et al., 2020). For instance, Malala Fund estimates that over 10 million secondary school learners in low- and middle-income countries may not return to schools due to interrupted learning caused by COVID-19, with these and many more girls believed not to have distance learning solutions provided by respective countries (Albright & Mwangi-Powell, 2020). Similarly, while interventions made by countries to continue students' home learning by governments and other education stakeholders are plausible, they are to a large extent exclusive in that the learning needs of learners with special needs are not comprehensively addressed. This offers a new dimension of the teaching and learning gap that should be urgently bridged (Ngware & Ochieng, 2020; United Nations Sustainable Development Group, 2020), for the attainment of a mutually inclusive learning. There are noteworthy initiatives in Kenya, including provisions for sign language interpretation to accompany teaching aired on TV but still, more needs to be done to address the needs of the different categories of learners living with special needs (Kenya Institute of Special Education, 2018; Ngware & Ochieng, 2020). Presently, the above-mentioned initiative only benefits deaf learners who can see but not hear (e.g., deafblind). The deafblind learners, on the other hand, are not able to benefit from either radio, TV, or online learning platforms, regardless of whether there is sign language interpretation on the TV screen or not.

While equitable access to digital infrastructure is necessary for all forms of learning—virtual or face-to-face—its relevance has never been more than now and for posterity. Countries, particularly the SSA countries, could benefit from an enhanced digital platform (including all features of digital technologies such as internet, electricity or solar power access, and respective digital technology devices) if the observed digital divide is to be eliminated.

Conclusion

It is a fact that the COVID-19 pandemic has adversely affected the education landscape. The effects of the pandemic, including physical school closures have proven that teaching and learning can still take place effectively through distant learning platforms especially where there are reliable and quality human capital, supportive devices, and appropriate infrastructure. In Kenya, the use of radios, TV, and internet-based platforms such as YouTube, Kenya Education Cloud, zoom, blue jeans, WhatsApp, and Google Classrooms among others have shown that learning and teaching can take place anywhere provided that enabling infrastructure is available. Much of these distance learning platforms have been in use in the Kenyan education system but the COVID-19 pandemic

led to their scaled utilization (Government of Kenya, 2020). However, due to poverty-related factors, some 6.1 million learners have been marginalized and left vulnerable putting them (the poor learners, girls, and learners with special needs) at risk of not accessing EdTechs for learning and teaching (Kenya National Bureau of Statistics, 2017, 2018). The bottom poor counties share the largest brunt given that 2.5 million learners come from the bottom nine counties in terms of child poverty index (Kenya National Bureau of Statistics, 2017, 2018, 2020a, 2020b). Associated with poverty at the household and individual level, there is a low level of access to EdTechs such as smartphones, tablets/computers/laptops, as well as low penetration of internet at the household level, which has hampered distance teaching and learning (Kenya National Bureau of Statistics, 2017, 2018). This is because access and use of EdTechs are a function of individual and households' SES, which puts the marginalized and vulnerable population at the greatest risk of missing out on distant/virtual learning. While some EdTechs such as the visual-enabled approaches offer to learn programs that are accompanied by sign language interpretation, other learners with special needs, for example, the deafblind remain underserved due to adopted EdTechs' inadequacies. Even in government's interventions to cushion its population from adverse effects of COVID-19, it is clear that special groups such as learners with special needs, the refugees, the stateless persons, and those in prisons among others are not yet adequately covered.

Policy Implications/Directives

To ensure social inclusion in education:

- Governments and other nongovernmental education stakeholders could invest in providing assistive learning devices for learners with special needs for home-schooling or better still, initiate distance learning solutions that respond to learners with special needs teaching and learning needs.
- The government(s) together with its development partners should initiate measures aimed at increasing both electricity and internet connectivity by ensuring learner populations access to electricity and internet (that support educational technological devices) is made available to all learners' households or learning centers/clusters that lack such digital infrastructure. This could include increased *partnerships* with the private sector to provide alternative digital learning solution technologies applicable to hard-to-reach areas and/or expand access to digital and related infrastructure in remote and marginalized areas.
- Equally, key education stakeholders should put in place a monitoring and evaluation framework for monitoring teaching and learning for learners of all levels, gender, and region notwithstanding. This is to ensure that learners are actually learning and in equal measure/proportion. This could help avert biased learning where either one gender participates in distance learning at the expense of the other, or where one region (mostly favored/well-endowed) benefits more from distance learning solutions compared to another (marginalized region).

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Notes

1. Both statistics are unweighted.
2. Lack of access to or lack of availability of more than one basic need, service, or right necessary for child's survival and development.
3. We include 18 year olds to cater for over-age as a result of late school entry and grade repetition.
4. Deaf-blindness is a combination of sight and hearing impairment. Physically challenged child is one with a disability of locomotors and neurological origin, which constitutes a disadvantage or restriction (Abraham, 2018; Jaiswal et al., 2018).

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