Resilience Through Inclusive Technology: How Organizations are Leveraging Innovative Technology to Achieve Education Outcomes for Learners with Disabilities

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Abstract

Education technologies have for long provided learning solutions. This became more important at the onset of the COVID-19 pandemic when physical learning was disrupted globally. Kenya has trailblazed in setting education standards that partly prepare the learners for technology in the region. One of the seven key competencies that the Competency-Based Curriculum (CBC) in Kenya aims to achieve is digital literacy, which sets the stage for the government and schools to implement and employ technology and innovation purposively. Using desk research, this paper documents the efforts by government and non-government organizations to leverage inclusive education technology in achieving education outcomes for learners with disabilities. Data were drawn from different programmes implemented nationally using literature review, document analysis and expert review. These technological interventions' key outcomes are increased access and interest in learning among learners with disabilities. The study concludes that inclusive education technologies have the potential to stimulate incredible skills among learners with disabilities. Learners with disabilities should not be confined to traditional ways of learning but should be exposed and supported to utilize new ways of learning that prepare them as thinkers and innovators who will contribute to solving the challenges of the future. The study recommends governments invest more in infrastructural, technical and human resources to achieve efficient and effective gender-responsive and inclusive education technologies. Facilitative policies should be developed to ensure such education technologies meet the various needs of learners with disabilities while utilizing universal design principles.

1.0. Introduction

Education technologies have for long provided learning solutions. This became more important at the onset of the COVID-19 pandemic when physical learning was disrupted globally. Learning from this experience, many countries are thinking of investing in solutions that ensure continued learning while contributing to sustainable development. Technology makes everything easy, including learning and preparing learners for the world of work. It is projected that most work will be technology-based in the coming years. The education and training ecosystem will evolve and innovation will drive the format in which education will be delivered. Increasingly, learning will migrate online and be self-directed and require some future employers to adapt to this reality. Many countries have embraced innovative and inclusive education technology solutions, whether homemade or exotic. High-income countries have achieved this to a desirable extent, while many low and middle-income countries contend with other competing priorities and economic burdens.

There remain gaps in how such skills benefit marginalized groups of learners, particularly those with disabilities. Therefore, this analysis documents the effort by the government and other partners to leverage innovative technology to achieve educational outcomes for learners with disabilities. Such education technologies should provide for the educational needs of learners with disabilities, recognizing the principles of accessibility, equality and non-discrimination as envisioned by the Convention on the Rights of Persons with Disabilities (CRPD).

2.0. Methodology

This paper analyzes education technologies interventions implemented in Kenya by government and non-government organizations. The authors provide information on the design of such interventions, their related outcomes, and insights on how the government and partners could replicate or scale up such interventions in inclusive technology.

3.0. Literature Review

3.1. Theoretical Framework of Education Technologies

The UNESCO and Regional Center for Studies on the Development of the Information Society (2016) proposed a framework for defining the measurement dimensions and indicators for ICT in Education. They identified key elements, including access, use and appropriation. The first component is access, whose indicators include ICT infrastructure for pedagogical use, school computerization programmes, broadband plans, ICT access outside the school, and ICT infrastructure for pedagogical use and school management. The second component is the use of ICT in pedagogical activities, curriculum bases, use of ICT outside school, collaborative

networks, and use of ICT for school management. The third element is appropriation, which requires using ICT for teacher training, formal and informal lifelong learning, acquisition of ICT competencies and skills and sharing of knowledge. These elements are identified as important in promoting the teaching and learning process. Bercker et al. (2005) argue that for ICT to be achieved, there is a need for ICT to be integrated into our everyday lives and social practices, including in schools. There should be a convergence between digital culture, social practices, public policies and educational goals (UNESCO, 2016) and the adoption of practices inherent in digital culture that bring about changes in schools and intersect with curriculum development (Almeida, 2014).

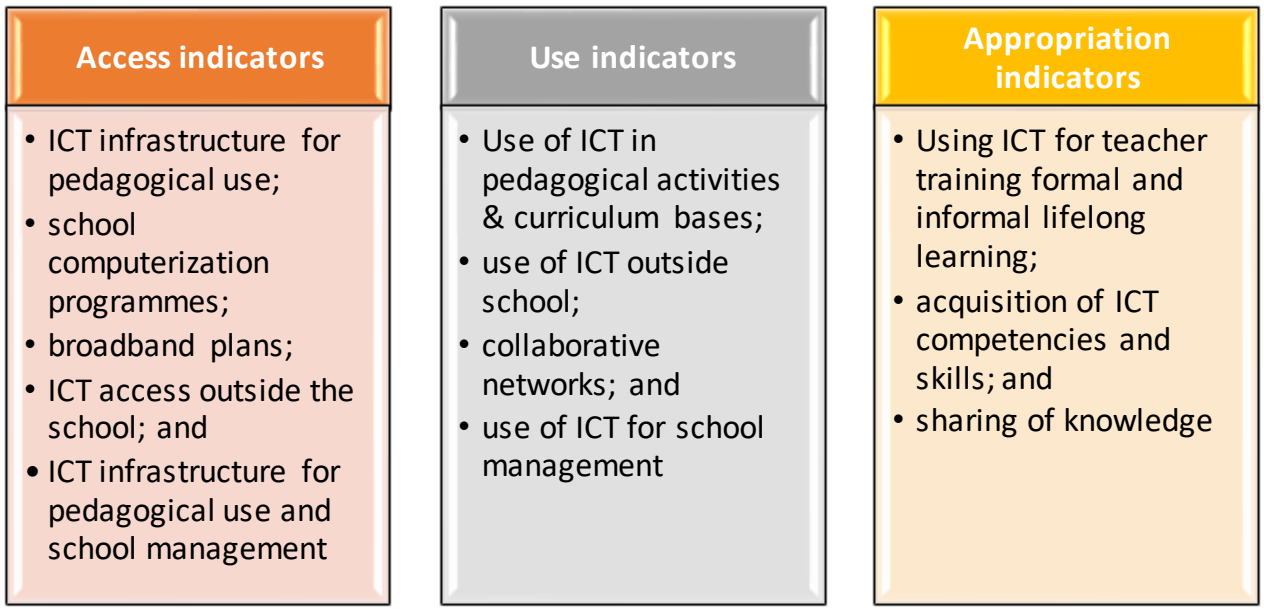

Figure 1: Conceptual Framework of Education Technologies (UNESCO & Regional Center for Studies on the Development of the Information Society (2016)

3.2. Challenges and Opportunities for Education Technology for Learners with Disabilities

One key barrier to accessing education technology is a lack of embrace of the digital culture. UNESCO (2016) notes that despite universal digital culture, many schools still do not use ICT because they do not have access to such technologies. Even more challenging, the conditions in the school do not allow them chiefly due to infrastructure and human resource capacity. The high cost of specialized technology for learners and trainees with disabilities remains a hindrance to the government's goal to provide education for all in line with the global goal of universal primary education (Muhombe et al., 2015). Though the government provides top-up grants to cater for specialized teaching and learning materials and other assistive devices for all learners with disabilities, this is far too inadequate to purchase sufficient teaching and learning materials in all institutions of learning. Technology for learners with disabilities remains higher than regular technology. For example, the cost of acquiring Orbital Readers

and talkback software remains out of reach for many students. Organizations such as Kilimanjaro Blind Trust Africa complement the government's efforts by providing Digital Assistive Devices such as orbit readers to learners with visual impairments in schools and colleges to ensure that every learner in school has access to a digital assistive device. At the same time, Kenyan schools have a low capacity for technology adoption. Many schools have no adequate skilled human resources to support digital literacy.

Ochieng and Murungi (2019), in a study "attaining 100 per cent transition from primary schools for learners with disabilities in Kenya," opine that education technology can significantly reduce learning materials' costs by replacing printed textbooks with e-materials. They also view inclusive education technology as a key tool to promote access, adaptability of content and transition to post-primary education, especially for learners with disabilities.

3.3. Legal and Policy Justification for Education Technologies

Providing education technology involves digital accessibility. Education accessibility is viewed as greater use of technologies and transforming information-based policies and the technology ecosystem (Gould, Leblois, Bianchi and Montenegro, 2014). Several legal and policy frameworks are highlighted that provide a basis for education technologies.

On the international front, the **Convention on the Rights of Persons with Disabilities (CRPD)** anchors the right to access education by persons with disabilities. Article 24 (2)(b) highlights their right to "access an inclusive, quality and free primary education and secondary education on an equal basis with others in the communities in which they live." Further, 2(d) requires they be provided with "the support required, within the general education system, to facilitate their effective education." Article 9 on accessibility requires States Parties to take appropriate measures to ensure persons with disabilities have "access to information and communications technologies and systems and promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage so that these technologies and systems become accessible at minimum cost." (UN, 2006).

In Kenya, the Constitution of Kenya (2010) Article 53 (1) (b) provides the right to education for every child. Further, Article 54 (1) entitles persons with disabilities to access to educational institutions and facilities, reasonable access to information, appropriate means of communication, and access to materials and devices to overcome constraints arising from the person's disability (Republic of Kenya, 2010). Additionally, the **Persons with Disabilites Act (2003)** Article 9 requires that every institution of education provides reasonable accommodation and provides learners with disabilities the appropriate core service or

services necessary to ensure equal access. One of the core services identified is textbooks and other educational materials in alternative media, including electronic format and access to adaptive equipment such as computer enhancements. Article 35 lists the government's incentives to reduce the costs of providing technological and other support for persons with disabilities. It provides exemptions for tax, demurrage, port charges, value-added tax and any other government levy for materials, articles and equipment to be used by individuals with disabilities, institutions and organizations of and for persons with disabilities (Republic of Kenya, 2003). One key policy is the **Sector Policy for Learners and Trainees with Disabilities (2018).** Through this Policy, the Ministry of Education plans to provide and adopt specialized learning resources, assistive devices and technology. One strategy to achieve this is to facilitate production, procurement, distribution and maintenance. Another strategy is facilitating access to tax waivers on specialized learning resources, assistive devices, and technologies for all learners and trainees with disabilities (MoE, 2018). Another important policy is the **Basic Education Curriculum Framework (2016),** which provides science and technology as an area of study. One of the seven key competencies that the Competency-Based Curriculum (CBC) in Kenya aims to achieve is digital literacy. Digital literacy sets the stage for the government and schools to implement and employ technology and innovation purposively. However, no particular study has documented how and the extent to which institutions of learning offer education to learners with disabilities by utilizing inclusive education technologies (Republic of Kenya, 2016).

The Kenya National Digital Master plan 2022-2032

The purpose of the Kenya National Digital Master plan 2022-2032 was launched in 2022, is to provide quality, accessible, affordable, reliable, quality, and secure ICTs in government with the positioning of Kenya as a globally competitive digital economy. The Master Plan is founded on four pillars: digital infrastructure, digital government service, product and data management, digital skills, and digital innovation, enterprise and digital business. To achieve education technology, the Master Plan prioritizes implementing two main flagship programmes, including installing 100,000km of high-speed fiber optic infrastructure to provide internet to all schools and the Digital Literacy Programme (Ministry of ICT, Innovation and Youth Affairs, 2022).

3.4. Existing Initiatives for Education Technology in Kenya

Kenya has made several attempts to provide education through technology. However, some current initiatives are generic and do not have adequate components to support learners with disabilities.

a) *The Digital Learning Programme (DLP)*

DLP is a flagship programme initiated in 2013 by the Government of Kenya through the Ministry of Education. This Programme did not initially take off due to challenges around leadership and inadequate stakeholder involvement until it was restructured in 2015. DLP has five key components, with each stakeholder charged with a responsibility. The components include project policy guidelines (Ministry of Education), content development (Kenya Institute of Curriculum Development, teacher training (Teachers Service Commission), school electrification (Kenya Power and Rural Electrification and Renewable Energy Corporation), facilitate set up of local assembly plants (Ministry of Industrialization) and provide learning devices to schools and coordinate implementation (ICT Authority).

The programme is being implemented in three phases: Phase I targets young learners of grades 1 to 3, phase II targets learners of grades 4-6, and phase III targets advanced learners of grades 7 and above. The roll-out of phase 1 was completed and now phase II is under implementation. Phase II aims at deepening the use of digital technologies in teaching and learning as a key enabler of the Competency-Based Curriculum. One key strategy for ICT uptake is to institutionalize ICT as a requirement for the promotion of teachers.

Part of DLP is the Laptop Project: School Net Programme, whose aim is to is to enhance the success of the digital literacy programme through effective delivery and update of content materials for all learners across the country. It also ensures full inclusivity in terms of internet connectivity to underserved areas. Schools will be connected using the available networking technologies, including fiber optic and wireless networks and VSAT with a minimum of 10MB bandwidth to enable effective content download. The Kenya Education Cloud server will be installed in each county for faster access to approved educational content by learners.

Some of the key achievements of DLP are highlighted. Firstly, over 24,000 primary schools have been connected with electricity. Secondly, the DLP has installed 1,169,000 digital learning and teaching devices in 21,638 public primary schools representing 99.6 % of both regular and special needs education schools. Of these, 1,571 devices were distributed to learners with disabilities nationally (Ministry of ICT, Innovation and Youth Affairs, 2022). Thirdly, the School Net Programme was piloted in 13 schools in December 2021 (UNESCO, 2021). Fourthly, in 2022, the Government of Kenya launched the Coding and Computer Programming Curriculum for public schools. The content was created in partnership with Kodris Africa and education technologies firm and approved by the Kenya Institute of Curriculum Development (ICT Authority, 2022). Lastly, 331,000 teachers were trained on ICT integration and 93,009 teachers on ICT devices (Ministry of ICT, Innovation and Youth Affairs, 2022).

b) STEM Model School Program

On behalf of the Ministry of Education, the Centre for Mathematics, Science, and Technology Education in Africa (CEMASTEA) seeks to transform the102 selected public secondary schools into model schools for STEM. Two secondary schools in every county and one in every region were selected based on their performance, locality and centrality in consultation with local stakeholders. Part of the programme activities was to train teachers on an interdisciplinary approach, education for sustainability, creativity, makerspace and introduction to robotics science. Another round of training from the STEM Model Schools was conducted to delve further into robotics science. CEMASTEA has developed a training kit to enhance learners' 21st-century skills and the kit has won international recognition (CEMASTEA, 2018).

c) *The UNESCO Digital STEM Mentorship Programme*

The UNESCO digital STEM mentorship programme was implemented in partnership with the Ministry of Education, NACOSTI, KNATCOM, Safaricom and the L'OREAL-UNESCO For Women in Science Programme. It was an 11-week programme that began in May 2020. It aimed to use technology to disseminate information on STEM to students across Kenya. The programme used the available online and media platforms to keep the students connected to STEM and STEM role models; the role models are aimed to inspire learners to embrace STEM through exposure to the beauty and power of science. This Programme complemented the education content delivered through television, radios and mobile phones by the government. It was an innovative adaptation in the wake of COVID-19 to ensure continuous learning. It also included a Life and Survival component in the mentorship to respond to some of the psychosocial challenges that faced learners during the COVID-19 period (UNESCO, 2020).

For transmission, mentors could record their voices to be aired through Kenya Broadcasting Corporation and community radio stations. The recorded content would also be translated into local languages for transmission in vernacular languages. To ensure a direct connection with the role models for continued mentorship, Safaricom established an interactive short code-messaging platform – the "ASK A STEM MENTOR PLATFORM." Through this platform, learners could send their questions and role models would decide on the most appropriate mode of response (UNESCO, 2020).

3.5. Education Technology Programmes Targeting Learners with Disabilities

According to the MoE (2018), several special secondary schools have established computer labs that provide adapted video-based content with audio for learners with visual impairment and signing for those with hearing impairment. The Kenya Institute of Special Education has set up three ICT labs with a capacity of about 90 users to prepare teachers for ICT integration. TVET institutions for trainees with disabilities have established laboratories that support ICT

integration in training courses. In this study, the accessible digital textbook and the Ibuka STEM Programme and inABLE Accessibility Technology Labs are featured.

a) *Ibuka STEM program*

The Action Foundation (TAF) is implementing an intervention aimed at increasing the interest of girls with disabilities in STEM-related subjects by training in robotics, coding, app development and establishing STEM hub schools. It is part of the TAF's wider goal of enhancing equitable access to active, quality, and learner-centered STEM learning for women and girls with disabilities throughout Kenya. The Project targets 30 schools spread in 17 counties of Kenya. This Project is funded by Google.org and implemented in partnership with the Ministry of Education-Kenya, Directorate of Special Needs Education (The Action Foundation, 2020).

It seeks to equip 2,650 learners, enabling them to think like innovators and problem solvers, equip them with 21st-century skills, and enhance their employability, thus reducing the gender gap in STEM professions through disability-responsive training and mentorship in STEM. This will be achieved by providing the tools, support, and environment to further their engagement in these fields while dispelling stereotypes that prevent them from taking up these subjects in schools.

The selected school is expected to model the best practice and culture of a STEM subjects' environment to other schools in the county and demonstrate school leadership practices. The school leadership practices include (a) a personalized vision of the STEM climate and culture; (b) STEM teachers' pedagogical and leadership practices both inside and outside classrooms; (c) demonstrable school-based teacher learning practices; (d) students activities - including enrollment and achievement in STEM subjects and participation in activities such as symposiums and science fairs. Other important dispositions for a model school are positive teaching and learning climate, productive and collegial relations between teachers and learners, and provisions of teaching and learning resources in quality and adequacy.

b) Accessible Digital Textbook

The Ministry of Education partnered with UNICEF, UNESCO, Kenya Institute of Curriculum Development (KICD) and e-Kitabu to develop and pilot an accessible digital textbook. The digital textbook was designed using principles of universal design for learning (UDL). The digital book allows learners chose the mode of learning they wish to use, including audio, sign language video and simplified text. This initiative aimed to remove barriers for children with disabilities and learners to have various choices depending on their learning needs and preferences (Unicef, 2020).

d) inABLE Accessibility Technology Labs

The mission of inABLE is to empower students who are blind and visually impaired in Africa through assistive computer technology. inABLE is implementing three programmes: computer labs for the blind, accessibility innovation tech lab and our reading spaces. Since 2009, inABLE has established eight assistive computer technology labs in six special schools for the blind and hired 20 computer instructors for assistive technology. Additionally, it has enrolled over 12,000 students who are blind and visually impaired and teachers and provided more than 35,000 hours of assistive technology computer skills training (inABLE, 2022).

When COVID-19 struck, inABLE piloted a distance-learning project with open educational applications and platforms that blind and low-vision students and teachers could use for remote learning. This Project reached 50 with plans underway for scale-up. The activities included training teachers, staff, students and caregivers on the accessibility features of the new devices, the creation and distribution of accessible learning content and the actual learning (inABLE, 2022).

4.0. Conclusions and Recommendations

The Kenyan case studies exhibit increased access and interest in learning among learners with disabilities. There is still a huge gap in Kenya and other low-and-middle income countries in providing inclusive education technologies. The case studies documented provide ideas for designing similar innovative and inclusive education technology interventions. From the analysis, inclusive education technologies, if harnessed, can equip learners with disabilities with the much-needed skills for a revolutionary world. Inclusive education technologies have the potential to stimulate incredible skills among learners with disabilities. The study recommends governments invest more in infrastructural, technical and human resources to achieve efficient and effective gender-responsive and inclusive education technologies. Facilitative policies should be developed to ensure such education technologies meet the various needs of learners with disabilities while utilizing universal design principles. Learners with disabilities should not be confined to traditional ways of learning but should be exposed and supported to utilize new ways of learning that prepare them as thinkers and innovators who will contribute to solving the challenges of the future. Failure to invest in inclusive education technologies has an imminent risk of perpetrating education inequalities and marginalization, which goes against the principles of inclusion as envisaged in the human rights instruments.

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