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Enhancing Student Skills through the Integration of Online Learning in Kenya's Competency-Based Curriculum (CBC)

Peter Ndiangui*[a], Francis Kamunya Mwangi[a] & Jingshun Zhang[a]

* Corresponding author
Email: pndiangui@fgcu.edu

a. College of Education, Florida Gulf Coast University, Fort Myers FL 33905 USA

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ABSTRACT

This study investigates the integration of online learning into Kenya's Competency-Based Curriculum (CBC), with the aim of improving educational access and equity. Although several educational reforms have been introduced in Kenya, challenges persist in fully implementing the CBC, including limited resources, technological gaps, and insufficient teacher training. The COVID-19 pandemic expedited the adoption of online learning, highlighting significant disparities in digital resource access between urban and rural areas. To evaluate the impact of online learning on student competencies, this research adopts a comparative approach, contrasting groups utilizing online tools with those relying on traditional teaching methods. The study employs cognitive diagnostic assessments to pinpoint specific areas of strength and weakness in students' knowledge and skills. In addition, concept mapping is utilized to visually organize and structure information, enhancing student understanding and retention. Findings from the study suggest that online learning can effectively increase student engagement, improve competency development, and provide more personalized learning experiences. To optimize the integration of online learning into the CBC framework, the study recommends key actions, including the enhancement of ICT infrastructure in rural schools to bridge the digital divide, the overhaul of teacher training programs to equip educators with digital pedagogical skills, and the implementation of inclusive policies ensuring equitable access to online resources for all students. Furthermore, the study encourages public-private partnerships to create tailored digital solutions addressing specific challenges in Kenya's education system. These efforts could significantly enhance the CBC's effectiveness, fostering more competent and skilled learners across the country.

KEYWORDS

Online learning; competency-based curriculum; digital divide; Kenyan Education

INTRODUCTION

Since gaining independence in 1963, Kenya has made significant curriculum reforms aimed at addressing political, socio-economic, and national goals. However, despite these reforms, the integration of online learning into the core of the education system has remained limited. Prior to independence, Kenya's education system was heavily influenced by colonial policies, which focused on basic literacy and vocational training tailored to specific roles in colonial administration (Sifuna, 1990). Following independence, the government introduced reforms to align education with national needs. One of the first major reforms was the 1968 Sessional Paper No. 10, which emphasized principles of access, equity, quality, and relevance in education (Republic of Kenya, 1968). This led to the establishment of the 7-4-2-3 system, structuring primary, secondary, and university education (Wanjohi, 2011). In 1985, the 8-4-4 system replaced the 7-4-2-3 system, aiming to provide a more practical, skills-oriented education (Ministry of Education,1981). The latest reform, initiated by the Kenya Institute of Curriculum Development (KICD) in the 2010s, is the Competency-Based Curriculum (CBC), which was implemented in 2018. This curriculum focuses on enhancing learners' competencies and skills development through a learner-centered approach, with an emphasis on achieving specific, benchmarked competencies (Orodho, 2014).

Despite the evolution of Kenya's educational reforms, online learning has remained outside the formal educational framework, although early efforts to incorporate technology into education were made. In the immediate post-independence period, the government introduced curricula aimed at "Africanizing" education to reflect the country's needs. One of the earliest technological innovations was the use of radio programs, particularly through the state-owned *Voice of Kenya (VOK)*, to broadcast educational content to primary schools. This marked the first significant attempt to extend learning beyond traditional classrooms (Sifuna, 1990). However, while such initiatives laid the groundwork for educational technology, online learning did not become central to the system.

In the past few decades, the rise of e-learning platforms has been driven by advancements in digital technology and internet connectivity, reshaping educational delivery in Kenya. This shift has been particularly evident in higher education, where institutions such as Kenyatta University, which initially began offering remote learning programs in the 1980s to address teacher shortages, played a pivotal role in promoting access to education (Ndiku & Kaluyu,2020). Similarly, the University of Nairobi established its Department of Education in 1988 to support distance learning, particularly for teachers (Adhola & Okungu, 2022).

By 2022, a report from *Standard Newspaper* revealed a surplus of approximately 350,000 professionally trained teachers in Kenya, attributed to the rapid increase in teacher training institutions over the past three decades. This surplus, coupled with the growing demand for online education, has led to an expansion of e-learning platforms across both public and private educational institutions. Universities such as Strathmore University, Kenyatta University, and

the University of Nairobi have developed robust online learning systems, offering a range of degrees and courses to meet the needs of a diverse learner population.

The Kenyan government has shown a long-term commitment to integrating technology into education. This began in 2000 with the establishment of the National Policy on Information and Communication Technology (ICT) Integration. This initiative, further reinforced by the 2006 National ICT Policy, aimed to improve ICT accessibility and reliability while promoting its integration into the education sector (Government of Kenya, Ministry of Education, 2006). Through various initiatives, such as the Kenya Education Sector Support Program (KESSP) and the Kenya Education Cloud (KEC), the government has sought to bridge the digital divide and promote ICT in education (Wango, 2011). The KEC, launched in 2012, provided a platform for equitable access to educational resources, especially in under-resourced areas, and played a key role in facilitating distance learning during the COVID-19 pandemic (Barasa, 2021, Evans-Amalu, & Claravall, 2021). Similarly, the introduction of Elimika-digital teaching materials in 2019 further supported remote learning during the crisis, although challenges such as limited resources and difficulties in assessing student learning outcomes remained (Barasa, 2021).

The integration of online learning presents a significant opportunity to enhance the implementation of the Competency-Based Curriculum (CBC) in Kenya. This study aims to explore how the incorporation of online learning can support the CBC's goals by investigating effective practices for training, implementation, and assessment across various educational levels. Online learning, facilitated through internet-enabled devices such as computers, tablets, and smartphones, offers a promising avenue to advance the development of competencies and skills among Kenyan learners.

Overview of Kenya's Competency-Based Curriculum

Kenya's Competency-Based Curriculum (CBC) is a dynamic educational framework designed to equip learners with critical skills, values, and attitudes needed in the 21st century. Unlike traditional education, CBC prioritizes the development of competencies over rote learning, emphasizing holistic growth.

The CBC is structured across three educational stages:

- Early Years Education (Pre-primary to Grade 3) focuses on social, emotional, cognitive, and physical development through play-based learning, nurturing foundational competencies in communication, numeracy, and life skills.
- Primary Education (Grades 4-6) builds on these foundations, introducing more complex subjects and practical skills like problem-solving, collaboration, and critical thinking, while continuing to develop literacy and numeracy.
- Secondary Education (Grades 7-12) delves deeper into specialized subjects, fostering analytical, creative, and critical thinking skills. Learners are given the freedom to choose subjects aligned with their interests, preparing them for higher education, vocational training, or the workforce.

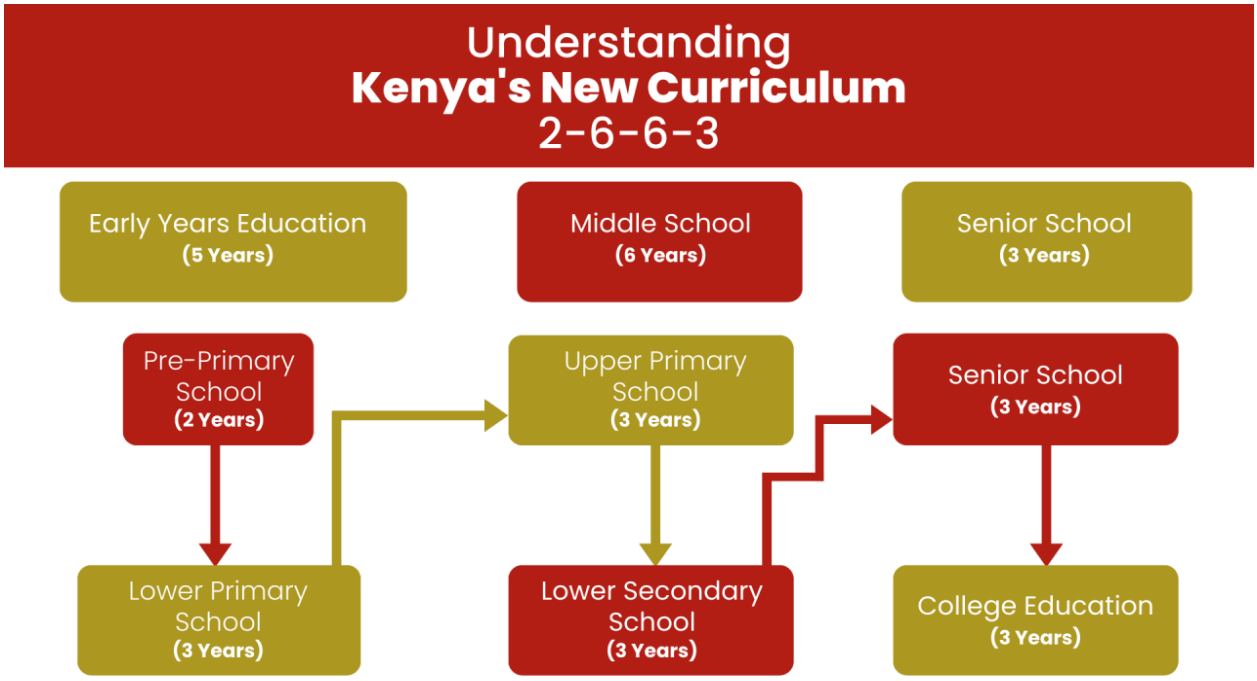
The curriculum also emphasizes vital 21st-century skills such as communication, collaboration, critical thinking, creativity, innovation, and digital literacy—skills essential for success in today's tech-driven world. CBC integrates a diverse range of learning areas, including languages, mathematics, science, social studies, and the arts, with a focus on applied learning. Cross-cutting issues like environmental education, peacebuilding, and values-based education are woven throughout to ensure that learners develop a sense of responsibility and global awareness.

Assessment in the CBC moves beyond memorization, focusing on competency development through continuous evaluation. This includes both formative and summative assessments, incorporating practical projects, group work, and written exams to track progress. The CBC also recognizes the importance of parental and community involvement in education, encouraging active participation and utilizing local resources to enrich learning.

Finally, the curriculum provides clear transitional pathways for learners, whether moving into vocational training, entrepreneurship, or further academic pursuits, all based on competencies acquired throughout their education. In essence, Kenya's CBC is designed to prepare learners for an unpredictable future, where adaptability, practical skills, and critical thinking are as essential as academic knowledge. The approach blends theory with real-world application, ensuring that students are well-equipped to navigate the complexities of the modern world.

Figure 1.

Structure of Kenya's CBC curriculum



From this diagram, it is noted that Kenya's Competency-Based Curriculum (CBC) focuses on developing learners' skills, values, and competencies for the 21st century, moving beyond traditional rote learning. It prioritizes holistic education across three stages—early years,

primary, and secondary—emphasizing practical skills like critical thinking, creativity, communication, and digital literacy. The curriculum integrates various learning areas with real-world application, incorporates cross-cutting issues like environmental education and peacebuilding, and uses continuous assessment to track competency development. By involving parents and communities and offering clear pathways for further education or vocational training, the CBC prepares learners to thrive in a dynamic, tech-driven world.

Research Objectives

The main objective of this study is to explore the integration of online learning into the implementation of the Competency-Based Curriculum (CBC) in Kenya. Specifically, the study will:

1. Investigate the current access to and use of online learning platforms in Kenyan secondary schools.
2. Examine the challenges faced in implementing online learning within the CBC curriculum framework.
3. Assess how increased use of online learning could enhance the development of competencies among learners at various levels of the CBC.
4. Identify the critical factors for the successful implementation and integration of online learning in Kenyan secondary schools.

Research Questions

The study will address the following research questions:

RQI. What is the current situation of access and use of online learning platforms in Kenyan secondary schools?

RQ2. What are the challenges of implementing online learning in the CBC curriculum of Kenya?

RQ3. How will increased application of online learning improve competency among learners at various levels of the CBC curriculum?

RQ4. What are the critical factors for successfully implementing and integrating online learning in Kenyan secondary schools?

LITERATURE REVIEW

As noted in several studies (Adhola, & Okungu, 2022; Barrett, & Cox 2012; Simiyu & Akach, 2021), the integration of online learning into Kenya's education system has been an ongoing process, with varying degrees of success and challenges. This literature review discusses the evolution of Kenya's educational reforms, the role of technology in education, and the challenges and opportunities related to the integration of online learning into the Competency-Based Curriculum (CBC).

Historical Context and Evolution of Kenya's Education System: Kenya's education system has undergone significant reforms since independence in 1963. Initially, the system was influenced by colonial policies that prioritized basic literacy and vocational training tailored to the needs of colonial administration (Sifuna, 1990). After independence, the government implemented

several reforms to address national socio-economic goals. One of the earliest reforms, Sessional Paper No. 10 of 1968, emphasized the principles of access, equity, quality, and relevance in education (Republic of Kenya, 1968). This was followed by the establishment of the 7-4-2-3 system, later replaced by the 8-4-4 system in 1985 (Ministry of Education, 1981), which aimed to provide more practical and skills-oriented education.

The current reform, the Competency-Based Curriculum (CBC), introduced in 2018 by the Kenya Institute of Curriculum Development (2019), focuses on competencies and skills development through a learner-centered approach (Orodho, 2014). The CBC emphasizes personalized learning and the development of practical skills, which aligns with global educational trends that advocate for skills-based rather than knowledge-based education (Mambo, 2020).

Early Attempts at Integrating Technology in Education: The integration of technology into Kenya's education system began in the post-independence period with early attempts to use media like radio to broadcast educational content to primary schools. The state-owned Voice of Kenya (VOK) played a key role in broadcasting lessons to enhance access to education in remote areas (Sifuna, 1990). These early efforts laid the groundwork for future technological advancements but failed to bring about a substantial shift toward online learning, as noted by Bennet and Lankshear (2007) in their review of the digital literacy debate.

Advancements in E-Learning and ICT Integration: In recent decades, advancements in digital technology and internet connectivity have led to a significant increase in e-learning platforms across Kenya, especially in higher education. Universities such as Kenyatta University and the University of Nairobi began offering distance learning programs as early as the 1980s, addressing challenges such as teacher shortages (Ndiku & Kaluyu, 2020). The government has also made strides in promoting ICT integration through initiatives like the Kenya Education Sector Support Program (KESSP) and the Kenya Education Cloud (KEC), which provides equitable access to educational resources, particularly in under-resourced areas (Barasa, 2021).

Despite these advancements, the integration of online learning into primary and secondary education remains limited. A report by the Ministry of Education in 2006 highlighted the importance of ICT in education, but challenges such as infrastructure deficits, limited teacher training, and disparities in access to technology have persisted (Government of Kenya, Ministry of Education, 2006). The COVID-19 pandemic further exposed these gaps, with schools struggling to shift to online learning due to inadequate resources and infrastructure (Barasa, 2021). Post Covid-19 research has also identified greater use of online learning even when it is not driven by other challenges (Matiso, 2024).

Opportunities and Challenges in Integrating Online Learning into CBC: The integration of online learning into the CBC presents both opportunities and challenges. On the one hand, online learning can enhance the development of competencies by offering personalized learning experiences, interactive content, and flexible learning opportunities. Research by Ndiku & Muhavi (2013) underscores the role of ICT in driving educational and economic growth,

highlighting how online platforms can foster the development of critical thinking, problem-solving, and technical skills among students.

However, significant barriers to the integration of online learning remain. A major challenge is limited access to technology. Disparities in access to digital devices and reliable internet connectivity between urban and rural schools contribute to an unequal educational experience. Research by Adhola and Okungu (2022) observed that while online learning initiatives have flourished in urban centers and private institutions, students in rural communities and public schools face significant barriers to participation due to inadequate infrastructure and resources. This digital divide exacerbates existing educational inequalities in Kenya.

Another key challenge is teacher readiness. Although the government has invested in teaching professional development, several educators still lack the necessary skills to effectively use online platforms and digital tools in teaching. Otieno (2020) emphasizes the importance of training teachers in new pedagogical competencies to ensure that they can effectively implement the learner-centered approach advocated by the CBC. Furthermore, digital literacy remains a challenge for both teachers and students. Incorporating digital literacy training into the curriculum is essential to ensure that students can effectively engage with online learning platforms and resources.

Connectivity issues further complicate the integration of online learning as observed by Barrett and Cox (2012). Slow and unstable internet connections, particularly in rural areas, limit the effectiveness of online platforms and create barriers to equitable learning. According to Barasa (2021), improving internet infrastructure is a critical step toward ensuring that online learning can be accessible to all students.

Finally, the issue of student engagement and motivation in online learning environments remains a concern. Without the physical presence of teachers and peers, maintaining student engagement and motivation can be challenging. Research has shown that interactive, gamified content and collaborative learning activities can improve student engagement in online settings (Ndiku & Kaluyu, 2020). However, these strategies require effective training and resources, which are not always available in the current context.

Government Efforts and Policy Frameworks: The Kenyan government has made significant efforts to promote ICT integration in education through various policies and initiatives. The National ICT Policy (2006) and the Kenya Education Sector Support Program (KESSP) have been central in driving ICT integration. The establishment of KENET in 1999, which provided high-speed internet connectivity to universities, played a pivotal role in improving access to online resources. Similarly, the Kenya Education Cloud (KEC), launched in 2012, aimed to bridge the digital divide by providing a platform for equitable access to educational resources (Wango, 2011). However, the full potential of these initiatives has yet to be realized, especially in secondary education, where online learning has not been fully integrated.

The incorporation of online learning into Kenya's CBC offers a distinctive and transformative chance to strengthen competency-based education while narrowing the divide between traditional and modern learning approaches. Although the government has made commendable progress in ICT integration, critical obstacles such as limited technological access, insufficient teacher training, connectivity challenges, and irregular student engagement need to be addressed to ensure the effective adoption of online learning in secondary schools (Sanga & Sifuna, 2014).

Future studies and policy initiatives should focus on ensuring fair access to technology, advancing comprehensive teacher training programs, and upgrading infrastructure to facilitate the widespread implementation of online learning in Kenya's education system. Insights from curriculum reforms and ICT integration experiences in South Africa, as discussed by Van der Westhuizen and Jansen (2020), provide valuable guidance that could help Kenya tackle these enduring challenges effectively.

THEORETICAL FRAMEWORK

This study draws upon several key theoretical frameworks that help to explain the integration of online learning into Kenya's educational system, especially within the Competency-Based Curriculum (CBC). These frameworks provide critical insights into the role of technology in learning, the challenges and benefits of online education, and the pedagogical shifts required to effectively implement digital learning under the CBC framework.

Constructivist Learning Theory (Piaget & Vygotsky)

Constructivist learning theory, particularly as articulated by Jean Piaget and Lev Vygotsky, emphasizes that learners actively construct knowledge through engagement with their environment and interactions with others (Piaget, 1952; Vygotsky, 1978). This approach is especially relevant to the CBC, which emphasizes learner-centered pedagogies. Piaget's cognitive development theory highlights that learners progress through stages of development and learn best when the content matches their cognitive abilities (Piaget, 1952). Online learning platforms can align with these stages by providing individualized content, enabling learners to engage at their own developmental level. Piaget argued, "The essential function of knowledge is to adapt it to the individual's growth" (Piaget, 1952, p. 7), a concept well-suited to personalized learning technologies.

Vygotsky's social constructivism, on the other hand, stresses the importance of social interaction and cultural context in learning, particularly through his concept of the Zone of Proximal Development (ZPD) (Vygotsky, 1978). In the context of online learning, platforms that incorporate collaborative tools, such as discussion forums and group projects, provide the social interactions Vygotsky deemed crucial for cognitive growth. According to Vygotsky, "*What a child can do in cooperation today, he can do alone tomorrow"* (Vygotsky, 1978, p. 86), reflecting the importance of collaborative learning for the development of higher-order competencies within the CBC.

Technology Acceptance Model (TAM) (Davis, 1989)

The Technology Acceptance Model (TAM) helps to explain how users come to accept and adopt technology, positing that perceived ease of use and perceived usefulness are key factors in the acceptance of new technologies (Davis, 1989). In the Kenyan context, these factors are critical to the successful integration of online learning into the CBC. According to Davis, "*Perceived ease of use refers to the degree to which using technology is free from effort*" (Davis, 1989, p. 320), which emphasizes the need for user-friendly platforms that both students and teachers can navigate effectively. Similarly, the perceived usefulness of online platforms—such as providing flexible learning paths, immediate feedback, and access to a wide array of resources—can drive engagement. Educators are more likely to embrace technology if they believe it enhances the learning process, as Davis suggested, "If a technology is perceived as useful, it is more likely to be accepted" (Davis, 1989, p. 320).

Diffusion of Innovations Theory (Rogers, 2003)

Rogers' Diffusion of Innovations theory provides a framework for understanding how innovations spread within a social system, which is essential for the widespread adoption of online learning in Kenya's education system (Rogers, 2003). Rogers identifies several key characteristics of innovations that influence their adoption: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). For online learning to be successfully integrated into Kenya's education system, it must be seen as offering clear advantages over traditional methods and be compatible with existing educational practices. Rogers emphasized, "Innovations that are perceived as having a relative advantage over previous ideas are more likely to be adopted" (Rogers, 2003, p. 15).

Additionally, the theory categorizes adopters into five groups: innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). Understanding these categories helps in identifying which schools and teachers are more likely to first adopt online learning, allowing for targeted support to facilitate wider adoption. As Rogers noted, "*The success of an innovation depends on how well it is communicated through certain channels over time*" (Rogers, 2003, p. 5).

Community of Inquiry Framework (Garrison, Anderson, & Archer, 2000)

The Community of Inquiry (CoI) framework, developed by Garrison, Anderson, and Archer, focuses on the essential elements of a successful online learning environment, namely social presence, cognitive presence, and teaching presence (Garrison et al., 2000). In the CBC context, these elements are crucial for fostering meaningful learning experiences. Social presence refers to the ability of students to feel part of a learning community, which is facilitated through communication and collaboration in online settings (Garrison et al., 2000). Cognitive presence involves the students' ability to engage in reflective inquiry, which is vital for deep learning. As Garrison et al. (2000) stated, "*Cognitive presence is the extent to which learners are able to construct meaning through sustained communication*" (p. 89), a process that can be supported by problem-solving tasks and critical thinking activities on online platforms.

Teaching presence is also integral; it refers to the teacher's role in facilitating the learning experience, guiding inquiry, and providing feedback (Garrison et al., 2000). Effective teacher training is essential for ensuring that teachers can actively engage students in the online environment. As Garrison et al. (2000) pointed out, "Teaching presence is crucial for creating a learning environment where students feel supported and motivated to participate in the learning process" (p. 93).

Critical Pedagogy (Freire, 1970)

Critical Pedagogy, as articulated by Paulo Freire, advocates for an education system that fosters critical thinking, social justice, and empowerment. Freire's model encourages students to question and challenge existing societal structures, a stance particularly relevant to the CBC's emphasis on developing competencies that prepare students to critically engage with the world (Freire, 1970). Freire argued, "*Education must begin with the solution of the teacher-student contradiction*" (Freire, 1970, p. 72), highlighting the importance of a reciprocal, dialogical relationship in learning. In this regard, online learning can empower students by providing access to diverse resources and enabling them to take control of their learning process, encouraging the kind of critical engagement that Freire envisioned.

In conclusion, the integration of online learning into Kenya's Competency-Based Curriculum is supported by several significant theoretical frameworks. Constructivist learning theory emphasizes the importance of learner-centered, interactive environments, while the Technology Acceptance Model highlights the factors influencing the adoption of digital tools. Rogers' Diffusion of Innovations theory provides insights into how new technologies spread, and the Community of Inquiry framework outlines the key elements of effective online learning environments. Finally, Critical Pedagogy calls for the empowerment of students to engage critically with their world. These theories collectively offer a strong foundation for understanding how online learning can be effectively integrated into Kenya's educational system to support the goals of the CBC.

Each of these theories supports the integration of online learning into the CBC framework, emphasizing personalized, interactive, and socially engaging learning environments while addressing the challenges and opportunities for adoption and implementation.

Table 1.

Summary of the theoretical framework for integrating online learning into Kenya's Competency-Based Curriculum (CBC)

Theory	Key Concepts	Relevance to Online Learning and CBC
Constructivist Learning Theory (Piaget & Vygotsky)	- Learners construct knowledge through interaction with their environment - Active, learner-centered approaches - Cognitive development stages (Piaget) - Social interaction and Zone of Proximal Development (ZPD) (Vygotsky)	- Online learning supports personalized, learner-centered experiences. - Platforms enable collaboration and competency-building at individual paces. - Online discussions and projects foster social learning.
Technology Acceptance Model (TAM)	- Perceived ease of use - Perceived usefulness	- If online learning tools are seen as useful and easy to navigate, teachers and students are more likely to adopt them. - Training teachers and providing user-friendly platforms are key to adoption.
Diffusion of Innovations Theory (Rogers)	- Innovation characteristics: Relative advantage, compatibility, complexity, trialability, observability - Adopter categories: Innovators, early adopters, early majority, late majority, laggards	- The adoption of online learning depends on its perceived advantages and ease of integration with existing practices. - Identifying adopter categories helps tailor support for different schools and communities.
Community of Inquiry (CoI) Framework	- Social presence - Cognitive presence - Teaching presence	- Effective online learning environments need social interaction, critical thinking, and strong teaching presence. - Ensuring engagement and reflective inquiry is key to competency development.
Critical Pedagogy (Freire)	- Critical thinking - Social justice - Empowerment through education	- Online learning can empower students by offering diverse resources for self-directed learning. - Encourages students to think critically and engage with societal issues, in line with CBC goals.

METHODOLOGY

This case study explored the use of online learning in Kenya, focusing on its evolution and current practices. Both qualitative and quantitative methods were employed to examine the effectiveness of online learning and the challenges it presented. Secondary data sources, including academic research studies, policy documents, and educational reports, were analyzed to identify best practices for integrating online learning and enhancing competency-based education.

The study employed cognitive diagnostic assessment (CDA) methods, particularly concept mapping, as outlined by Mugenda and Mugenda (2003). This approach helped to gain a deeper understanding of the cognitive processes involved in online learning, highlighting gaps in knowledge and learning strategies among Kenyan students. CDA was particularly valuable in examining how unequal access to technology—such as internet connectivity, digital devices, and electricity—impacted learning outcomes, exacerbating educational disparities. The research

also incorporated educational policy analysis, aligning with frameworks set by Amin (2019), to examine the broader context of educational development and the integration of technology.

This research contributed to the growing body of literature on the Competency-Based Curriculum (CBC), which was introduced in Kenya in 2018. Otieno (2020) emphasized the importance of teacher training in effective pedagogical methods for integrating technology into CBC delivery. The study investigated how teachers' technological proficiency and pedagogical innovations were crucial for the successful implementation of the CBC. While there has been significant research on online learning in Sub-Saharan Africa, few studies have focused specifically on secondary education in Kenya. Therefore, this research provided valuable insights into how secondary education can better integrate online learning tools and examined the challenges Kenyan schools faced during the transition to online platforms, especially during the COVID-19 pandemic when online learning became an urgent necessity.

Systematic reviews of cognitive diagnostic assessment (CDA) and modeling were conducted using concept mapping, as discussed by Zhang et al. (2011). These tools provided a more detailed analysis of how students processed and understood material in online learning environments, revealing areas where content retention and application were particularly challenging. Given that online learning in Kenya, despite its nationwide launch in 2009, was still in its early stages, this research critically examined the progress made and the gaps that remained. Ndiku and Muhavi (2013) noted the Kenyan government's recognition of ICT as a driver for economic growth, as emphasized in policy documents such as Sessional Paper No. 1 of 2005, the Kenya Education Sector Support Program (KESSP), and Vision 2030. These documents stressed the importance of ICT integration in education as essential for fostering innovation and enhancing Kenya's global competitiveness.

Evolution of Assessment Trends in Kenya Before and After Independence

Kenya's national assessment trends evolved significantly after gaining independence. During the colonial period, national assessments in Kenya, Uganda, and Tanzania were managed by the University of Cambridge Local Examinations Syndicate (UCLES). After independence, the East African Examinations Council (EAEC) took over the administration of assessments in East Africa until it was dissolved in 1976 following the collapse of the East African Community. In 1980, the Kenya National Examinations Council (KNEC) was established under the Kenya National Examinations Council Act Cap 225A. This law was later repealed and replaced by KNEC Act No. 29 of 2012, which strengthened KNEC's role in ensuring the validity, reliability, and alignment of assessments with Kenya's educational goals and government policies.

E-Learning or Online Teaching and Learning in Independent Kenya

The development of e-learning and online education in independent Kenya began in the late 20th century. The government made efforts to improve internet connectivity, which led to its widespread availability in educational institutions by the late 1990s and early 2000s. These initiatives laid the foundation for the adoption of e-learning platforms across the country. The Kenya Education Network (KENET), established in 1999, played a key role by providing high-

speed internet connectivity to universities and research institutions, enabling the growth of online education.

Various e-learning platforms emerged, offering online courses, digital resources, and interactive learning tools. Institutions such as the African Virtual University (AVU) and the Kenya Institute of Curriculum Development (KICD) played significant roles in advancing online education. Learning Management Systems (LMS) such as Moodle, Google Classroom, and Sakai were increasingly adopted by Kenyan universities to manage online courses, assignments, and assessments. These systems enabled students to pursue degrees and certifications through distance learning, prompting universities to expand their online course offerings.

Efforts to bridge the digital divide, particularly in rural areas, focused on improving internet access. Kenya's transition toward online learning was part of a broader shift from traditional classroom settings to digital learning environments, driven by the growing need to use technology to meet the demands of 21st-century education. This transition was further supported by government policies, such as Vision 2030, which emphasized the role of ICT in education and the necessity of equipping students with the skills needed for the digital economy.

RESULTS

Kenya's education system has seen gradual and dynamic shifts as online learning becomes more embedded within the Competency-Based Curriculum (CBC). The integration of digital tools and platforms at various educational levels—primary, secondary, and tertiary—has facilitated innovative approaches to teaching and learning, enhancing both the quality and accessibility of education. This section explores how online learning has been integrated at each educational level, highlighting key areas of CBC and the digital tools used to support learning.

Primary School: Fostering Competency Development and Personalized Learning: In primary education, the integration of online learning aligns with the CBC's emphasis on learning through competencies. E-learning resources are used to support a student-centered approach, where learners engage actively with materials rather than simply receiving information from teachers. Platforms such as Google Classroom, Zoom, Kahoot, and Edmodo provide a space for interactive learning, enabling teachers to create engaging lessons, quizzes, and collaborative spaces.

The personalized learning approach is another key component of the CBC, and online platforms play a pivotal role in delivering differentiated learning experiences. By using tools like interactive apps, YouTube, and Storybird, teachers can provide customized learning paths that cater to individual student needs. This ensures that learners progress at their own pace, allowing for more effective mastery of concepts.

Moreover, the real-world application of knowledge is encouraged through online resources that expose students to virtual field trips and online research. Virtual museums, Google Earth, and YouTube serve as gateways for students to explore history, geography, and

science in a manner that is both engaging and educational. These tools bridge the gap between classroom learning and real-world exploration, reinforcing the relevance of the material taught.
Secondary School: Building 21st-Century Skills and Enhancing Digital Literacy: At the secondary school level, the focus shifts to the development of 21st-century skills. Online learning platforms such as Google Drive, Microsoft Teams, and Moodle facilitate the creation of online assignments, collaborative projects, and group discussions. These platforms encourage students to work together on tasks, fostering collaboration, communication, and problem-solving skills—key competencies required in today's fast-paced world.

The CBC also emphasizes digital literacy integration in secondary education, helping students develop critical skills to navigate the digital world. Tools like Canva, Google Scholar, and Google Forms assist in honing these skills by providing students with the means to evaluate information, create digital content, and access scholarly resources. This digital fluency is essential for students to succeed academically and professionally in an increasingly digital society.

In addition, assessments and feedback are increasingly conducted online, a shift facilitated by platforms such as Moodle, Google Classroom, and Quizzes. These platforms enable teachers to administer e-assessments, collect results, and provide immediate feedback, enhancing the learning experience for students and allowing for a more efficient evaluation process.

Tertiary Education: Embracing Blended Learning, Research, and Professional Development

At the tertiary level, online learning is integrated into a blended learning approach, which combines face-to-face and online learning modalities. Platforms like Moodle, Zoom, Blackboard, and Coursera support this hybrid model, enabling universities to offer both synchronous and asynchronous learning opportunities. This flexibility allows students to access lectures and course materials online, while still participating in face-to-face discussions and practical sessions.

The emphasis on research and innovation is also significant at this level, with online platforms facilitating access to vast repositories of research materials. ResearchGate, JSTOR, and Google Scholar provide students and faculty with the tools needed to conduct academic research and collaborate with peers across the globe. These platforms ensure that learners at the tertiary level are well-equipped to engage in critical thinking and scholarly inquiry.

Furthermore, professional development is a major focus in tertiary education, especially for teachers and educational professionals. Online platforms such as LinkedIn Learning, edX, and Coursera offer a wide range of training programs that support continuous professional growth. These platforms provide opportunities for individuals to enhance their skills, gain new certifications, and stay updated on the latest trends in their fields.

In conclusion, the integration of online learning within Kenya's CBC at primary, secondary, and tertiary education levels highlights the dynamic role that digital tools and platforms play in modernizing education. From fostering competency-based learning in primary

schools to enhancing digital literacy and collaborative projects in secondary schools and advancing blended learning and professional development at tertiary institutions, online learning has become an essential component of Kenya's educational transformation. As integration continues, it promises to further enrich the learning experience, ensuring that learners are well-prepared for the challenges and opportunities of the 21st century.

Table 2.

Integration of Online Learning in CBC Curriculum

Level of Education	Key Areas of CBC	Online Learning Integration	Digital Tools/Platforms Used
Primary School	Learning through Competencies	E-learning resources are integrated to support student-centered learning.	Google Classroom, Zoom, Kahoot, Edmodo
	Personalized Learning	Online platforms provide differentiated learning paths for students.	Interactive apps, YouTube, Storybird
	Real-World Application	Virtual field trips and online research are encouraged.	Virtual Museums, Google Earth, YouTube
Secondary School	Development of 21st-century Skills	Online assignments, collaborative projects, and group discussions.	Google Drive, Microsoft Teams, Moodle
	Digital Literacy Integration	Online resources to enhance digital literacy and information evaluation.	Canva, Google Scholar, Google Forms
	Assessments and Feedback	E-assessments are conducted, and feedback is provided online.	Moodle, Google Classroom, Quizzes
Tertiary Education	Blended Learning Approach	Hybrid models combining face-to-face and online learning.	Moodle, Zoom, Blackboard, Coursera
	Research and Innovation	Online platforms facilitate research access and collaboration.	ResearchGate, JSTOR, Google Scholar
	Professional Development	Online training programs are provided for teachers.	LinkedIn Learning, edX, Coursera

Building passion for learning through technology

Figure 2 below depicts a Kenyan classroom where students are fully immersed in their studies, their faces lit by the soft glow of computer screens. This image captures the transformative shift in the country's educational environment. What was once a space dominated by chalkboards and textbooks now thrives with the energy of advanced technology, as students leverage the Internet to expand their knowledge significantly.

The students actively engage with a variety of online resources, some conducting detailed research for projects, while others watch captivating educational videos to strengthen their understanding of science, mathematics, or literature. Teachers provide thoughtful guidance, offering tailored support as needed to ensure that each student navigates the digital realm effectively and with a clear purpose.

This vibrant learning setting reflects the core principles of competency-based education, which prioritize active student participation and the cultivation of essential 21st-century skills, as discussed by Sharma and Dube (2018). The classroom exudes an atmosphere of enthusiasm and possibility. The integration of the Internet has unlocked access to an immense reservoir of

information, empowering students to learn beyond conventional boundaries. They are not merely passive recipients of knowledge but active learners, uncovering innovative ideas and building skills that are crucial for thriving in a digitally connected world.

Additionally, research by Cheung and Slavin (2013) highlights the effectiveness of educational technology applications in enhancing student achievement, reinforcing the positive outcomes observed in this Kenyan classroom.

This technological leap signifies more than just access to information—it is a step toward bridging educational gaps, fostering innovation, and preparing students for a future where digital literacy is key. In this Kenyan school, the classroom is no longer confined by the limits of geography or resources; the world is at the fingertips of these students, ready to be explored.

Figure 2.

Students in a Kenyan school using the Internet in classrooms

Influence of shortage of classrooms

Figure 3 below illustrates some of the challenges experienced in some rural parts of Kenya. The shortage of classrooms leads to some lessons being held under trees. Beneath the shade of a tall tree, a group of students in Kenya has found a quiet spot for an unconventional classroom activity. With laptops and tablets in hand, they are conducting an online survey, blending technology with the natural world around them. The tree's sprawling branches offer shelter from the midday sun, creating a perfect outdoor learning environment where students are focused and engaged in their task.

The students, working together in pairs or small groups, are collecting data for their survey, typing questions and responses into digital forms. Their survey might cover topics ranging from local community issues to environmental studies, tapping into the students' curiosity about the world around them. The setting is peaceful, with the soft rustling of leaves in the breeze adding an almost serene backdrop to the lively exchange of ideas among the students.

Despite the simplicity of their surroundings, the students are immersed in the world of digital learning, showcasing how technology can empower them even in rural settings. With access to the Internet, they can gather data, analyze results, and present findings—skills that will serve them well in their future academic and professional lives.

This scene represents more than a simple lesson in survey methodology; it captures the convergence of tradition and innovation. The tree, symbolizing nature and stability, contrasts with the modern tools utilized by the students, underscoring the dynamic evolution of education in Kenya. It stands as a testament to the remarkable adaptability of both students and educators, demonstrating that learning can thrive in any environment when equipped with appropriate resources. The thoughtful integration of technology empowers learners to access extensive knowledge on the principles of distance learning, as eloquently discussed in Keegan's (2017) insightful research

Figure 3.

Students conduct an online survey under a tree.

Strategies of integrating online learning in the CBC curriculum in Kenya

The incorporation of online learning into Kenya's Competency-Based Curriculum (CBC) is a central element of the country's educational reform, designed to offer students a more inclusive and adaptable learning environment. The CBC framework prioritizes a learner-centered approach, emphasizing the development of competencies and skills essential for the 21st century. This aligns with Bingimlas's (2009) review of literature on ICT integration, which highlights the importance of these aspects in achieving effective 21st-century education.

Teacher Training and Capacity Building is one of the foundational strategies for the successful integration of online learning. Teachers are provided with training on how to integrate Information and Communication Technology (ICT) into their teaching methods. This includes regular workshops and online certifications to help educators build their capacity to use digital tools and platforms effectively. By improving teachers' digital literacy, they are better equipped to teach and assess students using online resources, ensuring the success of the CBC framework. This aligns with the findings of UNESCO (2021) which emphasizes the critical role of teacher training and capacity building in the successful implementation of e-learning initiatives in Africa

The use of digital content and resources is another strategy within the CBC. Instead of relying solely on textbooks, the curriculum promotes digital tools to enhance learning. These include e-books, educational apps, and YouTube videos, offering students additional materials. These resources diversify learning, making it interactive and engaging by catering to various

learning styles. Ngware and Macharia (2016) emphasize the critical role of digital resources in improving education, especially in rural areas where access to traditional materials is limited.

Collaboration and Communication are also emphasized in the online learning integration strategy. Students are encouraged to participate in collaborative learning activities that promote interaction and teamwork, regardless of geographical location. Online group projects and video conferences enable students to collaborate on tasks, share ideas, and communicate effectively. This not only enhances their learning experience but also equips them with important skills in digital communication and cooperation, which are essential in the modern world.

Inclusive Learning Practices ensure that digital learning tools cater to the diverse needs of learners. The CBC framework seeks to create an inclusive learning environment where students of all abilities can succeed. This strategy involves providing tools such as speech-to-text applications, audio books, and interactive quizzes, which can support students with disabilities or different learning preferences. By addressing diverse learning needs, the curriculum helps ensure that all students have equal opportunities to succeed, irrespective of their challenges.

Monitoring and evaluation of student progress in online learning is a crucial aspect of the integration strategy. Continuous assessments and feedback mechanisms facilitate a dynamic and responsive learning process. Online quizzes, automated grading systems, and peer reviews provide teachers with real-time data on students' understanding and progress, enabling them to offer timely support and guidance. As part of the policy, as captured by Wachira and Gachohi (2019), this approach ensures that learning is individualized and tracked, fostering an environment where students can continuously improve.

Table 3.

Strategies for Online Learning Integration in CBC

Strategy	Description	Examples
Teacher Training and Capacity Building	Teachers are trained in ICT integration for online teaching.	Regular workshops, online certifications in ICT.
Use of Digital Content and Resources	Digital tools and resources are used to supplement traditional textbooks.	E-books, educational apps, YouTube videos
Collaboration and Communication	Students engage in online collaborative learning activities.	Online group projects, video conferences
Inclusive Learning Practices	Digital learning tools cater to diverse learning needs.	Speech-to-text apps, audio books, interactive quizzes
Monitoring and Evaluation	Continuous online assessments and feedback mechanisms for learners.	Online quizzes, automated grading, and peer reviews

In conclusion, these strategies are integral to the successful integration of online learning into Kenya's CBC curriculum. By focusing on teacher training, digital resources, collaboration, inclusivity, and continuous evaluation, the CBC framework aims to create a robust educational environment that prepares students for the challenges and opportunities of the future.

Challenges in integrating online learning into the CBC curriculum

Integrating online learning into Kenya's Competency-Based Curriculum (CBC) offers a wealth of opportunities for improving education and preparing students for the digital age. However, despite the potential benefits, there are several challenges that hinder the smooth implementation of online learning in the CBC framework. These challenges need to be addressed effectively to ensure that all students have equal access to quality education.

Limited Access to Technology. Not all learners, especially those in rural or low-income areas, have access to the necessary digital devices or a reliable internet connection. This digital divide means that some students may be excluded from online learning opportunities. To address this challenge, the government and other stakeholders must work together to provide affordable devices, expand internet connectivity, and offer alternative offline learning materials that can be used in areas with limited internet access.

Teacher readiness is another significant barrier to the integration of online learning. Teacher Readiness is another significant barrier to the integration of online learning. As Ouma et al. (2013) observed, some teachers lack the skills or confidence to effectively use online platforms and digital tools for teaching. Many educators, particularly in rural schools, may not have been trained in ICT integration. This gap in teacher readiness can undermine the success of online learning. Ongoing professional development programs in ICT for teachers are essential to equip them with the necessary skills and ensure that they can confidently engage with digital teaching platforms and deliver effective online instruction (Ouma et al., 2013).

Digital Literacy of Learners is another challenge. While students today are tech-savvy, many may still lack the skills required to navigate specific online learning tools and platforms effectively. Students need to be able to use various online applications, communicate via video calls, and engage with digital content to succeed in an online learning environment. Incorporating digital literacy training into the CBC curriculum is a critical solution to this issue, ensuring that students develop the necessary skills from an early age.

Connectivity issues also pose a significant hurdle to online learning. Slow or unstable internet connections, as Davis (2014) pointed out, can severely hinder the effectiveness of online lessons, particularly in remote or underdeveloped areas. This issue makes it difficult for students to access real-time classes or participate in online assessments. To overcome this challenge, the government must focus on improving internet infrastructure across the country, especially in rural areas, and provide offline resources that students can use when connectivity is unavailable.

Equity and Inclusion present another challenge when integrating online learning into the CBC curriculum. Disparities in access to technology and the internet between urban and rural areas can exacerbate educational inequalities. In light with Warschauer (2003) research findings, students in rural regions or those from economically disadvantaged backgrounds may find it difficult to fully participate in online learning. Government initiatives aimed at ensuring equitable access to technology, such as subsidizing internet costs or providing devices to

disadvantaged students, are crucial in addressing these inequities and creating a more inclusive learning environment.

Student Engagement and Motivation is a challenge that many educators face in online learning environments (Mathrani, Sarvesh, & Umer, 2022). It can be difficult to keep students engaged and motivated when they are learning from home, where distractions may be more prevalent. The absence of face-to-face interaction with peers and teachers can also reduce students' sense of connection and motivation. To combat this, educators can use interactive and gamified content to make lessons more engaging. Fostering peer collaboration through online platforms can also help to maintain a sense of community and encourage students to take an active role in their learning.

Table 4.

Challenges in Integrating Online Learning into CBC

Challenge	Description	Possible Solutions
Limited Access to Technology	Not all learners have access to digital devices and internet.	Provide affordable devices, expand internet connectivity, and offer offline materials.
Teacher Readiness	Some teachers lack the necessary skills to use online platforms effectively.	Ongoing professional development programs in ICT for teachers.
Digital Literacy of Learners	Students may have insufficient skills to navigate online learning tools.	Incorporate digital literacy training in the curriculum.
Connectivity Issues	Slow or unstable internet connections hinder effective online learning.	Improve internet infrastructure and provide offline resources.
Equity and Inclusion	Disparities in technology access exacerbate educational inequality.	Government initiatives to ensure equitable access to technology in rural areas.
Student Engagement and Motivation	Maintaining student engagement during online learning can be difficult.	Use interactive, gamified content and foster peer collaboration through online platforms.

In conclusion, while integrating online learning into the CBC curriculum in Kenya holds enormous potential, several challenges must be overcome to ensure its success. By addressing issues such as limited access to technology, teacher readiness, digital literacy, connectivity, equity, and student engagement, Kenya can create a more inclusive and effective online learning environment that benefits all students. With a coordinated effort from the government, educational institutions, and communities, these challenges can be mitigated, ensuring that the CBC framework achieves its goal of providing high-quality, learner-centered education in the digital age.

Integration of online assessments in Kenya

Kenya's primary and secondary students are assessed through internal exams by teachers and external exams by the Kenya National Examination Council (KNEC), which track learning progress and mastery. Formative assessments in upper primary contribute 10% to the final grade before the Grade 6 summative national assessment. Students then progress to junior and senior secondary levels, with standardized exams at Grades 9 and 12 determining their placement in universities, diploma colleges, or TVET institutes. Kenya National Examination Council (2020).

According to KNEC (2020), the council oversees a diverse array of assessments and professional examinations beyond the Kenya Certificate of Primary Education (KCPE) and the Kenya Certificate of Secondary Education (KCSE). These include diploma and certificate examinations for educators and academic institutions, technical and vocational education, and training (TVET) examinations for polytechnics, and foreign language proficiency. Examinations in languages such as Italian, French, and Spanish for individuals pursuing second-language skills. It also conducts National Assessments for Learners with Special Needs, supporting institutions like Thika School for the Blind. Additionally, KNEC administers professional examinations across various domains, including accounting (CPA), information and communication technology (CICT), corporate governance (CS), and business management, providing essential qualifications for professional advancement.

While KNEC has made big strides in providing online assessments for professional bodies in Kenya, it has yet to fully implement this for its core business, the assessments of KCPE and KCSE, aside from the Computer Paper's practical component, which is conducted online. Another achievement is the online registration of primary and secondary candidates. Despite challenges such as exam malpractice, KNEC remains a reputable testing organization with internationally recognized certificates, contributing significantly to Kenya's education and skill development across various academic, professional, and vocational levels.

Online assessment in Kenya, at the county, national, and professional levels, has evolved significantly since the country gained independence in 1963. In the Early Years and Pre-Independence times, Kenya relied primarily on traditional paper-based assessments due to limited technological capabilities. However, post-independence, especially up to the early 2000s, the education system underwent gradual modernization and digitization, with computers and the internet slowly gaining traction in educational institutions. Despite these advancements, national examinations like the Kenya Certificate of Secondary Education (KCSE) and the Kenya Certificate of Primary Education (KCPE) continued to be conducted using traditional pen-and-paper methods. By the mid-2000s, there was a notable shift towards digital technologies in education, with the Kenya National Examinations Council (KNEC) exploring online platforms for registration and some aspects of examination management. The introduction of e-learning platforms and digital assessment tools began to influence teaching and evaluation methods in schools and universities, and county governments started adopting online platforms for assessments, particularly in government recruitment and local education initiatives. The 2010s marked a period of significant growth in online assessments across Kenya, with KNEC launching online registration for candidates sitting for national exams like KCSE and KCPE (KNEC, 2020).

Competency Based Curriculum (CBC) in Kenya.

Kenya introduced the Competency-Based Curriculum (CBC) in 2018, transitioning from the 8-4-4 system. CBC emphasizes developing learner competencies, with assessment focusing on how well students acquire specific skills. Both formative and summative assessment strategies are

utilized (Republic of Kenya, Ministry of Education, 2017). The COVID-19 pandemic significantly accelerated the adoption of online learning in Kenya, driven by factors such as technology advancement, infrastructure development, and the need to ensure educational continuity during lockdowns (Wachira & Mwai, 2021). While online learning has become prominent globally, national examinations in Kenya still rely on traditional structure.

Change does not come easily

Figure 4 below captures a moment during the national examination period in Kenya, highlighting a traditional examination setting. In this image, candidates are seen seated at individual desks in a primary school classroom, intently writing their examination papers with pen and paper. This scene offers a vivid snapshot of the longstanding examination culture in the country, where handwritten responses remain the standard despite global advancements in digital technology.

The image is particularly significant as it underscores the deeply entrenched nature of traditional exam formats in Kenya's educational landscape. The continued reliance on paper-based exams, even as digital tools and methods become more prevalent worldwide, speaks to the challenges that lie ahead for the country in transitioning to a more modern and technologically advanced system. While digital education platforms and online learning have made significant strides in recent years, especially in urban areas, the broader adoption of online national examinations remains distant.

This image, taken from a 2020 report by the Kenya National Examinations Council (KNEC), serves as a striking reminder of the traditional examination system still in place across the country. This method, deeply entrenched in educational culture, highlights the challenges faced in transitioning to a more digital approach. The scene in the figure makes it clear that, despite the rapid advancements in technology globally, Kenya still has a considerable distance to cover before implementing online national examinations. Factors such as limited access to technology, infrastructure disparities, and the need for comprehensive training of both candidates and examiners underscore the long road ahead for such a transition.

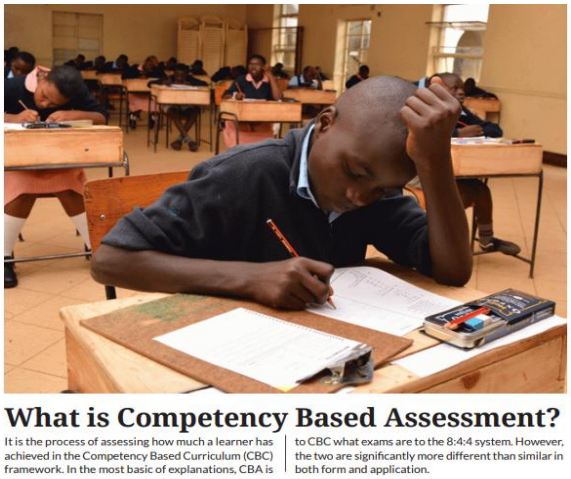
This gap can be attributed to several key factors. First, limited access to technology remains a considerable barrier. A significant portion of Kenya's population, particularly in rural areas, still lacks reliable access to digital devices and the internet. This disparity in access to technology means that many students would be at a disadvantage in a digital exam setting. Additionally, the country faces significant infrastructure challenges, with not all schools equipped with the necessary resources, such as computers, internet connectivity, and electricity, to facilitate the smooth administration of online exams.

Another crucial factor is the need for extensive training and capacity-building for both students and examiners. The transition from paper-based assessments to digital formats would require comprehensive training programs to ensure that all stakeholders—candidates, teachers, and examiners—are proficient in using the technology required. This transition would also require ensuring that the digital platforms used for exams are secure, reliable, and capable of maintaining fairness and integrity throughout the examination process.

The scene depicted in Figure 4 serves as a poignant reminder of how far Kenya must go to bridge the digital divide in education. While there is recognition of the need for modernization, especially in the context of global digital advancements, Kenya's path toward online national examinations is still impeded by a range of logistical, infrastructural, and social challenges. The country is at a critical juncture where embracing technology in education is essential, but the pace and scale of this shift require careful consideration and substantial investment to overcome the existing barriers.

Figure 4.

Candidates writing national examinations (traditional exam) in Kenya (KNEC, 2020)



DISCUSSION

The integration of online assessments into Kenya's educational system, particularly within the framework of the Competency-Based Curriculum (CBC), presents a significant opportunity to modernize and enhance the effectiveness of assessments at various educational levels. While Kenya has made some strides in digitizing certain aspects of its assessment processes, the widespread adoption of online assessments, particularly for national exams such as the Kenya Certificate of Primary Education (KCPE) and the Kenya Certificate of Secondary Education (KCSE), remains a challenge. This section delves into the benefits, challenges, and future implications of online assessments in Kenya, offering insights on how they could reshape the educational landscape.

Benefits of Online Assessments

Online assessments have the potential to improve Kenya's education system in various ways, especially by supporting the goals of the CBC, which focuses on continuous, personalized learning. One of the key advantages of online assessments is the ability to provide real-time feedback. This feature is particularly valuable in the context of the CBC, which emphasizes formative assessment over summative testing. Real-time feedback enables students to track their progress, identify areas for improvement, and adjust their learning strategies. For teachers, online assessments reduce the administrative burden of manual grading, allowing

them to focus more on delivering quality instruction and tailoring their teaching approaches based on data-driven insights.

In addition, online assessments offer greater flexibility compared to traditional paper-based tests. These assessments can be taken at any time and from virtually any location, addressing logistical barriers for students in remote or underserved regions. This increased accessibility aligns with the inclusive goals of the CBC, ensuring that students, regardless of their geographical location, could participate in assessments. Furthermore, online assessments allow for the incorporation of multimedia elements—such as videos, interactive exercises, and simulations—that can better assess a wide range of competencies and align with the development goals of the CBC. These multimedia features also engage students in more dynamic and interactive ways than traditional pen-and-paper tests.

Challenges in Implementation

Despite the clear advantages, the implementation of online assessments in Kenya faces several significant challenges. A primary obstacle is the digital divide between urban and rural areas. While cities and towns may have the necessary infrastructure to support online assessments, many rural regions lack reliable internet access and digital devices, making it difficult for a large portion of the student population to participate in online assessments. This disparity exacerbates existing educational inequalities and threatens the goal of providing equal learning opportunities for all students.

Another critical challenge is teacher preparedness. While many Kenyan teachers are adept at using traditional assessment methods, a considerable number lack the digital literacy required to utilize online assessment platforms effectively. This gap in digital skills not only hinders teachers' ability to administer online assessments but also limits their capacity to integrate technology meaningfully into their pedagogical practices. To successfully implement online assessments, teachers must be equipped with the necessary technical skills and knowledge to create and manage online assessments that align with the CBC's goals (Ochieng, 2019). Additionally, resistance to technology adoption in certain areas, especially in rural regions where traditional teaching methods are deeply entrenched—can further complicate efforts to introduce online assessments.

Furthermore, concerns around the reliability and security of online assessment platforms must be addressed. Online assessments, like traditional exams, are vulnerable to issues such as cheating and fraud, and the shift to digital platforms could amplify these concerns if security measures are inadequate. Ensuring the integrity of the assessment process is crucial, and this involves developing secure, tamper-proof systems that safeguard against malpractice. Moreover, data privacy issues, especially in handling sensitive student information, must be considered when designing and implementing online assessments.

Implications for the Future

The future of online assessments in Kenya is promising, but it requires strategic planning and investment in infrastructure, teacher training, and policy development. First and foremost,

addressing the digital divide is essential. Expanding internet access to rural areas and providing affordable digital devices will help ensure that online assessments can be accessed by all students, regardless of their location. Public-private partnerships and government investment will be key to bridging this gap and enabling widespread access to online learning tools.

In addition to infrastructure improvements, teacher training programs must be implemented to ensure that educators are equipped with the skills needed to design and administer online assessments effectively. These programs should focus on both technical competencies and pedagogical approaches, helping teachers create assessments that foster critical thinking, problem-solving, and other competencies central to the CBC. As teachers become more adept at using technology, they will be better positioned to support the individualized learning needs of their students.

The Kenya National Examinations Council (KNEC) will play a critical role in managing the shift to online assessments. KNEC must invest in strengthening the technical infrastructure required to support online assessments, focusing on security, scalability, and usability. Collaboration with international institutions and best practice models from other countries will be invaluable in ensuring that Kenya's online assessment systems are robust and reliable.

Lastly, the integration of online assessments into the broader educational framework will require policy adjustments. Policymakers must ensure that online assessments align with the learning objectives of the CBC and prioritize the development of competencies rather than rote memorization. A clear policy framework is needed to guide the equitable and ethical implementation of online assessments, ensuring that no student is disadvantaged due to technological barriers or lack of resources.

In conclusion, the transition to online assessments in Kenya offers both significant challenges and opportunities. While obstacles such as infrastructure limitations, teacher preparedness, and security concerns must be addressed, the potential benefits—such as increased accessibility, real-time feedback, and multimedia integration—make online assessments an essential part of the future of education in Kenya. By making strategic investments in technology, teacher training, and policy development, Kenya can create a more inclusive, effective, and innovative assessment system. Ultimately, online assessments hold the potential to transform the way learning is evaluated, better preparing students for success in a rapidly evolving global economy and positioning Kenya as a leader in modernizing education across Africa.

SIGNIFICANCE

This study is of paramount importance for gaining a comprehensive understanding of the current landscape of online learning within Kenyan secondary schools under the Competency-Based Curriculum (CBC) framework. It critically examines the extent to which online platforms are accessible and utilized, uncovers the key obstacles hindering effective implementation, and assesses how seamlessly online learning can be integrated to elevate student competencies

across the various CBC levels. The COVID-19 pandemic has dramatically underscored the necessity of technology in education, highlighting an urgent and non-negotiable demand for the broader adoption of online learning. The pandemic revealed technology's transformative potential, demonstrating its capacity to not only sustain learning in the face of disruptions but also to drive innovations in education. New online learning platforms, mobile applications, and offline resources were swiftly developed to address critical accessibility issues and cater to the diverse needs of learners.

The significance of this study lies in its timely and direct response to the pressing need for effective incorporation of online learning within the CBC framework in Kenya. By thoroughly investigating the challenges and opportunities associated with the integration of online learning, this study aims to provide concrete, actionable insights that can guide educators, policymakers, and curriculum developers in shaping the future of education in Kenya. These insights are essential for crafting robust online learning strategies, improving the overall quality of education, and ensuring that every student—irrespective of their geographic or socioeconomic background—has equal access to these transformative educational opportunities. Furthermore, the study will pinpoint the critical factors necessary for the successful and sustainable implementation of online learning, offering a clear and actionable roadmap for optimizing educational outcomes in an increasingly digital world.

Beyond its local relevance, the findings of this study have the potential to contribute to a broader, global dialogue on the role of technology in education. By providing insights into the complexities of integrating online learning into diverse educational systems, the research can inform the best practices that can be adapted and applied worldwide, ensuring that the promise of digital education is fully realized in a variety of contexts.

Limitations

This research anticipates several significant challenges for future studies, many of which stem from underlying structural limitations within the educational system. One of the most critical challenges is the limited access to reliable internet and digital devices among both students and teachers, especially in rural areas and economically disadvantaged regions. This lack of access can result in skewed findings, as it may prevent a representative sample of the student population from fully participating in online learning, thus limiting the generalizability of the results. This issue could also create disparities in the experiences and outcomes of different groups of students, further complicating the interpretation of the data.

Another key limitation arises from the insufficient teacher training and preparedness to effectively use online learning tools. While many educators have some familiarity with digital platforms, a significant portion lacks the advanced skills and pedagogical strategies required to leverage technology for meaningful student engagement and competency development. This lack of expertise among teachers may undermine the potential of online learning, leading to suboptimal teaching practices and reduced effectiveness of the digital learning environment.

Cultural resistance to adopting technology-driven teaching methods also poses a substantial barrier. In many communities, there is a deep-rooted preference for traditional face-to-face teaching methods, and any shift toward online or digital education may be met with skepticism, fear, or outright rejection. This cultural resistance can slow the adoption of online learning tools and prevent teachers and students from embracing new pedagogical models, limiting the overall impact of technology on education.

Additionally, accurately measuring competency improvements that can be directly attributed to online learning is a complex and multifaceted challenge. The Competency-Based Curriculum (CBC) itself is already multifaceted, and isolating the effect of online learning from other variables influencing student performance is difficult. Many external factors, such as parental support, learning environments, and individual student characteristics, also play a role in competency development, which makes it challenging to attribute improvements solely to the online learning experience.

The potential for bias in data collection is another critical concern, particularly when participation is uneven. Students in urban areas may be more likely to engage with online learning, leading to an overrepresentation of their experiences, while students in rural or underprivileged areas might be left out due to infrastructure limitations or socio-economic challenges. This unequal participation could skew findings, affecting the study's validity and accuracy.

Moreover, securing adequate funding and resources to implement and evaluate online learning initiatives on a comprehensive scale remains a fundamental hurdle. Many schools, particularly in underserved regions, face budget constraints that limit their ability to invest in the necessary technology, infrastructure, and teacher training programs. Without sufficient financial resources, it is difficult to create a sustainable and scalable online learning model, let alone conduct thorough evaluations that can provide a true measure of its impact.

Finally, there is the issue of the rapidly evolving nature of digital tools and educational technologies. As online learning platforms and resources are continually updated and changed, ensuring that the research remains relevant and up to date could be challenging. A fast-paced technological landscape may also lead to discrepancies in the types of tools and resources available at the time of the study versus those available to future learners, affecting the long-term applicability of the research findings.

In summary, these limitations underscore the complexity of conducting research on online learning in the Kenyan secondary school context and highlight the need for careful consideration of access, equity, and resource constraints. These challenges must be carefully addressed in future studies to ensure that findings are both reliable and applicable to broader educational contexts.

CONCLUSION

This study examined the integration of online learning within Kenya's Competency-Based Curriculum (CBC) and aimed to assess both the challenges and opportunities that exist in this transition. The findings highlighted significant disparities in access to and use of online learning platforms across secondary schools, which were often influenced by differences in resource availability and the varying levels of digital literacy among students and educators. The research identified several key challenges hindering the widespread adoption of online learning, including limited technological access, insufficient teacher training, inadequate infrastructure, and concerns related to equity and inclusivity. These barriers are critical to address for the effective and equitable integration of online learning into the CBC, as they directly impact the quality and accessibility of education offered to students across the country.

The challenge of limited technological access is particularly acute in rural and marginalized areas, where schools often lack basic infrastructure like computers, stable electricity, and reliable internet connectivity. According to the Ministry of Education in Kenya (2021), many schools in these regions still struggle with outdated or non-existent technological resources, which exacerbates the digital divide between urban and rural learners. Similarly, a lack of comprehensive teacher training in the use of digital tools for education has contributed to the slow uptake of online learning. Research by Origi (2020) found that even when technology is available, many educators in Kenya are ill-equipped to use it effectively due to insufficient professional development in online teaching methods. Moreover, issues surrounding equity and inclusivity remain prominent, with some students, especially those from low-income families, unable to access the necessary devices or internet services to participate in online learning effectively (Oduor & Ochieng, 2022).

Despite these challenges, the potential benefits of integrating online learning into the CBC are substantial. The study underscores how online learning can enhance learner competencies by offering personalized and flexible learning experiences that cater to the diverse needs of students. In a framework like the CBC, which prioritizes the development of practical skills and critical thinking, online learning can play a crucial role in promoting higher-order thinking and problem-solving abilities among students. According to Njeri (2021), online platforms allow learners to access a wealth of educational resources, engage in interactive learning, and receive instant feedback, all of which are essential for developing the competencies outlined in the CBC. By facilitating more individualized learning, online platforms can help students progress at their own pace, improving engagement and outcomes.

Furthermore, online learning can contribute to fostering a more learner-centered environment in line with the CBC's emphasis on holistic development. It can provide students with the opportunity to explore subjects beyond the traditional classroom curriculum, enabling them to develop interests and skills in areas such as digital literacy, entrepreneurship, and creative arts (Mwangi & Ndirangu,2020). This is particularly important as Kenya seeks to prepare students for success in a rapidly changing global economy where digital skills and adaptability are increasingly vital.

However, realizing these benefits requires addressing the foundational challenges identified earlier. To ensure the effective integration of online learning into the CBC, several critical success factors must be prioritized. First, ensuring that all schools have access to reliable and high-speed internet is essential. A study by Oketch (2020) emphasized that internet connectivity is a fundamental requirement for successful online education, and improving this infrastructure should be a national priority. In addition, providing ongoing professional development for teachers is necessary to equip them with the skills needed to effectively use online teaching platforms and tools. Training programs that focus on the pedagogy of online learning, as well as technical skills in managing digital classrooms, should be rolled out at a national scale (Bediako, 2021). Moreover, the development of high-quality, CBC-aligned digital learning materials is essential for enhancing the teaching and learning experience. These resources must be designed to engage students and support the curriculum's competencies, including critical thinking, collaboration, and creativity.

The study also highlights the importance of inclusivity in the integration of online learning. To address the disparities in access to technology, the government and stakeholders must work to ensure that all students, regardless of their socio-economic background, have equal access to the tools and resources needed to participate in online learning. This includes providing affordable devices and subsidizing internet access for students from disadvantaged backgrounds. Additionally, the curriculum should be designed in such a way that it accommodates students with diverse learning needs, ensuring that online learning is accessible to all.

In conclusion, while the integration of online learning into the CBC faces several challenges, the potential benefits it offers for enhancing learner competencies and preparing students for the demands of the 21st century are considerable. By addressing the barriers of access, teacher preparedness, and infrastructure, Kenya can create an education system that fully embraces the advantages of online learning. This will require collaborative efforts from government bodies, educators, and technology providers to ensure that the necessary resources, training, and support are in place. With a strong commitment to these goals, Kenya could transform its education system and equip students with the skills they need to succeed in a globalized and digitally driven world. The findings from this study offer valuable insights for future research and provide guidance for policymakers on how to effectively implement and expand online learning within the CBC framework, ensuring that all students could thrive.

Recommendations

Based on the findings of this study, several recommendations are proposed to enhance the integration of online learning within Kenya's Competency-Based Curriculum (CBC). These recommendations target policymakers, educational institutions, and key stakeholders engaged in the digital transformation of the education sector. By addressing the challenges outlined in this study and implementing the recommendations below, Kenya can fully harness the potential of online learning within the CBC framework. Sustained investments in infrastructure, teacher

training, and equitable access, combined with strong stakeholder commitment, are essential. These efforts will not only improve educational outcomes but also equip Kenyan students to succeed in an increasingly digital and interconnected global economy. Here are the most significant recommendations from this study:

Expanding Internet and Technological Infrastructure:

One of the primary recommendations is the expansion of internet connectivity and technological infrastructure, particularly in rural and underserved areas (Wanzala, 2019). It is essential for the government, in partnership with private-sector stakeholders, to prioritize investments in providing reliable, high-speed internet access to all schools. Subsidies or funding programs should be established to ensure affordability for schools and students in disadvantaged regions. Additionally, the infrastructure improvements must focus on supplying essential hardware, including computers, tablets, and digital learning devices, to both educators and students (Kariuki et al., 2020).

Implement Comprehensive Teacher Training Programs:

There is an urgent need for comprehensive, ongoing professional development programs that equip teachers with the necessary skills to utilize online learning tools effectively. Teacher training should focus on technical competencies, such as navigating digital platforms, alongside pedagogical strategies that align with the CBC (Boit et al., 2021). Educators should be trained in online assessment techniques, managing virtual classrooms, and developing CBC-aligned digital resources. This continuous capacity-building process will enable teachers to integrate online learning seamlessly into their instructional practices, fostering better student engagement. As noted by Kilinc, Et.al. (2016). This will improve the more traditional teachers' attitude towards online teaching.

Address Equity and Inclusivity Concerns:

To ensure equity in access to online learning, specific interventions must be designed to enable all students, regardless of their socioeconomic background, to participate in digital education (Kamau, 2020). The government and stakeholders should launch initiatives such as device subsidies and free or low-cost internet provision. Partnerships with technology providers to supply devices to low-income families should also be prioritized. Furthermore, digital content should be inclusive, catering to students with diverse learning needs, including those with disabilities or special education requirements (Odhiambo & Ocholla, 2021).

Enhance the Security and Integrity of Online Assessment Platforms:

To preserve the integrity of online assessments, stringent security measures should be enforced by the Kenya National Examinations Council (KNEC) and other relevant authorities (Ndonga, 2021). It is vital to develop secure online platforms that safeguard against cheating, data breaches, and exam malpractice. Measures such as identity verification protocols, secure browsers, and encryption for sensitive student data should be integrated. A clear policy framework on data privacy and examination integrity will help build public trust in the online assessment process.

Develop High-Quality Digital Learning Content Aligned with the CBC:

The development of engaging, competency-based digital resources is crucial to support the CBC's goals (Mugambi & Njoroge, 2022). Content developers, curriculum experts, and educators should collaborate to create multimedia-rich learning materials that foster critical thinking, problem-solving, and creativity. These resources must be interactive, culturally relevant, and adaptable to the diverse contexts in which Kenyan students learn. Furthermore, digital platforms should offer real-time feedback to enable continuous assessment, a core feature of the CBC.

Foster Collaboration Between Government, Schools, and Private Sector Partners:

Successful integration of online learning into the CBC will require coordinated efforts from multiple stakeholders, including the Ministry of Education, KNEC, schools, and technology providers (Ochieng et al., 2021). Public-private partnerships should be encouraged to ensure sustained funding, infrastructure development, and resource provision. Regular consultations with educators, students, and parents will help identify challenges and develop effective strategies in real-time.

Monitor and Evaluate the Implementation of Online Learning:

To ensure successful integration, continuous monitoring and evaluation mechanisms must be established. Regular assessments of student performance, teacher efficacy, and the accessibility of online learning tools should be conducted (Choge et al., 2021). These evaluations will help policymakers gather data-driven insights to refine implementation strategies and address gaps in the system.

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