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Original Article

Leveraging Technology to Promote the Implementation of Competency-Based Curriculum in Kenya and Uganda

Cornelius Kipleting Rugut, PhD[1*]

[1] Lira University, P. O. Box 1035, Lira, Uganda.
[*] Author for Correspondence ORCID ID; https://orcid.org/0000-0001-9159-7364; Email: rugutc@gmail.com

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ABSTRACT

Despite growing investments in digital technologies and the adoption of Competency-Based Curriculum (CBC) reforms in Kenya and Uganda, there remains limited evidence on how technology can be strategically leveraged to support effective CBC implementation. Existing studies have largely examined curriculum reforms and technology integration separately, with insufficient synthesis of the opportunities, challenges, and practical strategies for technology-supported competency-based learning in the two countries. This study examined the role of technology in promoting the implementation of CBC in Kenya and Uganda. The study employed a qualitative desk review design based on a systematic analysis of peer-reviewed literature, government policy documents, curriculum frameworks, and reports from international organisations published between 2017 and 2026. Data were analysed using thematic content analysis to identify emerging patterns related to technology integration and CBC implementation. The findings revealed that technology enhances learner-centred pedagogy, personalised learning, continuous assessment, teacher professional development, digital literacy, communication, and access to educational resources. Technologies such as mobile learning platforms, virtual learning environments, digital assessment tools, and educational applications were found to significantly improve learner engagement and competency acquisition. However, inadequate infrastructure, limited teacher preparedness, unequal access to digital technologies, financial constraints, and persistent rural–urban disparities continue to hinder effective implementation. The study recommends increased investment in digital infrastructure, continuous teacher capacity building, development of localized digital content, equitable access policies, and strengthened stakeholder partnerships. The study concludes that technology is not merely a supporting resource but a critical driver of successful CBC implementation capable of improving educational quality, reducing learning inequalities, and preparing learners for participation in the digital knowledge economy.

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INTRODUCTION

Education systems across the globe are increasingly shifting from traditional content-based instruction toward competency-based approaches that emphasise the acquisition of practical skills, values, attitudes, and real-world problem-solving abilities (UNESCO, 2021). This transformation has been driven by rapid technological advancement, globalisation, labour market changes, and the growing recognition that conventional examination-oriented systems are insufficient for preparing learners for modern social and economic realities. In many African countries, educational reforms have focused on developing curricula that nurture creativity, innovation, communication, critical thinking, collaboration, and digital literacy among learners (Mweru, 2020). Competency-based curriculum has therefore emerged as a strategic response to the need for education systems that produce adaptable and productive citizens.

In East Africa, both Kenya and Uganda have adopted Competency-Based Curriculum (CBC) reforms as part of broader efforts to improve educational quality, relevance, and learner preparedness for the demands of the twenty-first century. Kenya officially introduced the Competency-Based Curriculum in 2017 to replace the 8-4-4 system, which had long been criticised for encouraging memorisation and examination performance at the expense of practical skill development (Mwang'ombe, 2021). The new curriculum seeks to empower learners with the competencies necessary for lifelong learning and socio-economic development. Similarly, Uganda introduced competency-based reforms in lower secondary education beginning in 2020 with the aim of promoting practical learning, creativity, continuous assessment, and learner participation. The Ugandan reforms were designed to address concerns regarding graduate unemployment, limited practical skills among learners, and inadequate alignment between education and labour market needs (Ministry of Education and Sports Uganda, 2020).

The successful implementation of CBC requires significant transformation in teaching methodologies, assessment systems, teacher roles, learning resources, and educational management (Darling-Hammond, 2020). Technology has become a vital tool for supporting these changes because it facilitates learner-centred instruction, flexible learning, interactive content delivery, digital assessment, collaboration, and communication. During the COVID-19 pandemic, both Kenya and Uganda relied heavily on digital learning platforms, television lessons, radio broadcasts, and mobile technologies to sustain learning during school closures. The experience demonstrated both the opportunities and inequalities associated with educational technology in the region (World Bank, 2020).

Technology is increasingly recognised as a critical pillar in supporting curriculum reforms because it enables innovative pedagogical approaches that align with the principles of competency-based

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learning (Mtebe & Gallagher, 2022). Digital technologies provide learners with opportunities for active participation, independent research, collaboration, creativity, and practical application of knowledge. In Kenya, the government launched the Digital Literacy Programme aimed at distributing digital devices to primary schools and promoting digital content aligned with CBC objectives. Similarly, Uganda has expanded ICT integration through teacher training initiatives, digital learning programs, and curriculum reforms emphasising information and communication technology competencies (KICD, 2024; NCDC Uganda, 2020).

Despite increasing attention to Competency-Based Curriculum reforms and educational technology in East Africa, limited evidence exists on how technology can be effectively leveraged to support CBC implementation, particularly in both Kenya and Uganda. There is a need for a clearer synthesis of the opportunities, challenges, and strategies that can enhance technology-supported competency-based learning across the two countries. This study addresses this gap by examining the role of technology in promoting effective CBC implementation in Kenya and Uganda.

Problem Statement

The implementation of Competency-Based Curriculum (CBC) in Kenya and Uganda has created significant opportunities for developing learners' practical skills, creativity, critical thinking, collaboration, and digital literacy. Technology is widely recognised as a critical enabler of CBC because it supports learner-centred pedagogy, continuous assessment, personalised learning, and access to educational resources. However, despite government investments in digital learning initiatives and ICT integration programs, the effective use of technology in supporting CBC implementation remains uneven due to inadequate infrastructure, limited teacher preparedness, digital inequalities, financial constraints, and disparities between urban and rural schools. Existing studies have largely examined CBC implementation challenges or technology integration in education separately, with limited attention to how technology can be strategically leveraged to strengthen CBC implementation, particularly in Kenya and Uganda. Furthermore, there is insufficient synthesis of evidence on the opportunities, barriers, and practical strategies required for sustainable and inclusive technology-supported competency-based learning in the two countries. This knowledge gap necessitates a comprehensive examination of the role of technology in promoting effective CBC implementation and improving educational outcomes in Kenya and Uganda. Consequently, there is a need to examine how technology can be strategically leveraged to support effective CBC implementation, enhance educational quality, and ensure equitable access to competency-based learning opportunities in the two countries.

Study Objective

The main objective of this study was to examine how technology can be leveraged to promote the implementation of Competency-Based Curriculum in Kenya and Uganda. Specifically, the study sought to explore the role of technology in enhancing learner-centred pedagogy, continuous assessment, teacher professional development, digital literacy, and access to educational resources within CBC frameworks. The study also aimed to analyse the opportunities and challenges associated with technology integration in education systems and propose practical strategies that can strengthen competency-based learning in both countries.

Methodology

This study employed a qualitative desk review design to examine how technology can be leveraged to support the implementation of Competency-Based Curriculum (CBC) in Kenya and Uganda. Data were collected through a systematic review of relevant literature, including peer-reviewed journal articles, government policy documents, curriculum framework reports,

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publications from international organisations such as UNESCO, UNICEF, and the World Bank, and other scholarly sources published between 2017 and 2026. The reviewed documents were selected based on their relevance to technology integration, competency-based education, teacher development, digital learning, and educational reforms in the two countries. Data were analysed using thematic content analysis, where key themes related to opportunities, challenges, and strategies for technology-enhanced CBC implementation were identified and synthesised to generate evidence-based conclusions and recommendations.

Understanding Competency-Based Curriculum

Competency-Based Curriculum is an educational approach that focuses on the development and demonstration of competencies rather than the mere acquisition of theoretical knowledge. Competencies involve a combination of knowledge, practical skills, attitudes, and values that enable learners to perform tasks effectively in real-life situations (Mishra & Koehler, 2019). CBC emphasises learner-centred pedagogy where learners actively participate in constructing knowledge through inquiry, collaboration, creativity, and problem-solving activities. Unlike traditional systems that focus heavily on examinations and memorisation, competency-based learning emphasises mastery of skills and continuous assessment.

In Kenya, the CBC framework follows the 2-6-3-3-3 structure comprising two years of pre-primary education, six years of primary education, three years of junior secondary education, three years of senior secondary education, and three years of tertiary education. The curriculum is anchored on core competencies, including communication and collaboration, critical thinking and problem-solving, creativity and imagination, citizenship, digital literacy, self-efficacy, and learning to learn (KICD, 2024). These competencies are intended to prepare learners for national development and participation in the global economy.

Uganda's competency-based curriculum similarly emphasises practical learning and application of knowledge. The lower secondary curriculum introduced by the National Curriculum Development Centre focuses on developing critical thinking, creativity, communication, cooperation, and digital literacy among learners. Teachers are encouraged to use learner-centred pedagogies such as project-based learning, discussions, research activities, and continuous assessment. The curriculum aims to equip learners with employable skills and entrepreneurial abilities necessary for Uganda's socio-economic transformation (NCDC Uganda, 2020).

The shift toward competency-based education in both countries reflects broader international trends emphasising twenty-first-century skills. According to UNESCO (2021), education systems should prioritise competencies that enable learners to adapt to changing technologies, labour markets, and social conditions. This shift requires teaching approaches that encourage active participation rather than passive reception of information. Technology, therefore, becomes essential because it supports flexible, interactive, and learner-centred instructional practices.

Leveraging Technology to Promote CBC Implementation

The implementation of CBC can be strengthened by leveraging technology in different ways, as discussed in this section.

Technology and Learner-Centred Pedagogy

Technology has become a transformative force in education because it supports innovative teaching methodologies, expands access to educational resources, and enhances learner engagement. In the context of Competency-Based Curriculum, technology facilitates learner-centred instruction by enabling interactive learning experiences, collaborative projects, digital assessment, and personalised learning pathways (Fullan, 2020). Educational technologies create opportunities for learners to explore concepts practically and

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develop competencies that extend beyond theoretical knowledge.

One of the major ways technology promotes CBC implementation is through learner-centred pedagogy. Competency-based learning requires learners to actively participate in the learning process, collaborate with peers, conduct research, and solve real-life problems (UNESCO, 2023). Digital tools such as tablets, computers, interactive whiteboards, and educational applications make learning more engaging and interactive. In Kenya, the government's Digital Literacy Programme introduced digital devices in public primary schools to support interactive learning and digital literacy development. Learners in many schools use tablets to access educational content, complete assignments, watch instructional videos, and participate in digital learning activities aligned with CBC objectives (Ministry of Education Kenya, 2026).

Personalised Learning through Technology

Technology also supports personalised learning, which is a key principle of CBC (Kohnke & Moorhouse, 2021). Learners possess different abilities, learning styles, and interests, and technology enables instruction to be tailored according to individual needs. Adaptive learning systems can monitor learner progress and provide customised content based on strengths and weaknesses. In Uganda, some secondary schools have adopted e-learning platforms that allow learners to access lessons at their own pace and receive immediate feedback on assessments. Such systems promote mastery learning and encourage learner independence, which are central goals of competency-based education (World Bank, 2022; East African Community, 2026).

Digital Assessment and Competency Evaluation

Digital technologies enhance assessment practices within CBC because competency-based learning requires continuous and formative assessment rather than reliance on final examinations alone (Redecker, 2021). Teachers can use online quizzes, e-portfolios, digital projects, and virtual presentations to evaluate learner competencies. Digital assessment tools enable educators to track learner progress efficiently and provide timely feedback. In Kenya, some private and urban public schools have adopted Google Classroom and Moodle platforms for assignment submission, learner evaluation, and communication between teachers and students. These platforms facilitate competency tracking and reduce administrative burdens associated with manual assessment systems (Mishra & Koehler, 2019).

Teacher Professional Development and Capacity Building

Teacher professional development is another critical area where technology supports CBC implementation (Darling-Hammond et al., 2020). Successful curriculum reform depends heavily on teachers' pedagogical competence and digital literacy. Online training platforms, webinars, virtual workshops, and professional learning communities enable teachers to continuously improve their instructional skills. In Kenya, the Teachers Service Commission and Kenya Institute of Curriculum Development have conducted digital training programs to help teachers understand CBC methodologies and integrate technology into classroom instruction (TSC Kenya, 2022). Similarly, Uganda has organised ICT training workshops for teachers to enhance their capacity in digital pedagogy and competency-based assessment.

Access to Digital Educational Resources

Technology further promotes access to educational resources and learning materials (World Bank, 2022). Traditional textbook-based learning often limits learners to a narrow range of information sources. Through digital technologies, learners and teachers can access online libraries, educational videos, academic journals, simulations, podcasts, and open educational resources. In Uganda, the Ministry of Education collaborated with development partners during the COVID-19 pandemic to

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distribute digital learning content through online portals, television programs, and radio lessons. These initiatives demonstrated the potential of technology to support learning continuity and expand educational access beyond classrooms (UNICEF, 2021).

Mobile Learning and Flexible Education

Mobile technology has emerged as a particularly important tool for supporting CBC implementation in East Africa because of the widespread use of mobile phones (Traxler & Crompton, 2021). Mobile learning platforms provide educational content, revision materials, quizzes, and communication services that support learning beyond classrooms. In Kenya, Eneza Education has successfully utilised mobile phones to deliver educational content and revision materials to learners in both urban and rural areas. The platform enables learners to access educational support even in low-resource settings where computers may not be available. Similar mobile learning initiatives have been introduced in Uganda to support remote learning and digital literacy development.

Virtual Laboratories and Simulation Technologies

Virtual laboratories and simulations are increasingly important in science and technical education because they provide learners with opportunities for practical experimentation without requiring expensive physical equipment (Makransky & Petersen, 2021). In schools with limited laboratory resources, digital simulations can help learners understand scientific concepts through interactive experiments. Some national secondary schools in Kenya are now building the infrastructure for virtual science laboratories that will allow learners to conduct chemistry and physics experiments digitally. These technologies align closely with CBC principles, emphasising practical learning and problem-solving.

Communication and Collaboration in CBC

Technology additionally facilitates collaboration and communication among educational stakeholders (Trust & Whalen, 2020). Competency-based learning encourages collaborative learning experiences where learners work together to solve problems and complete projects. Digital platforms such as Zoom, Google Meet, WhatsApp, and Microsoft Teams enable learners and teachers to communicate effectively and collaborate beyond physical classrooms. Parents can also monitor learner progress through digital school management systems. In many Kenyan schools, WhatsApp groups have become important channels for communication between teachers and parents regarding learner progress, assignments, and school activities.

Digital Literacy and Twenty-First Century Skills

The integration of technology into CBC also promotes digital literacy, which is itself a core competency within both Kenyan and Ugandan curricula (Voogt et al., 2021). Learners who engage with digital tools acquire practical technological skills essential for employment, entrepreneurship, and participation in the digital economy. Kenyan schools implementing coding and robotics programs provide learners with opportunities to develop computational thinking and innovation skills. In Uganda, some urban schools have introduced ICT clubs where learners practice coding, multimedia creation, and digital problem-solving activities aligned with competency development goals.

Artificial Intelligence and Emerging Educational Technologies

Artificial intelligence and data analytics also present emerging opportunities for improving competency-based education (Zawacki-Richter et al., 2021). AI-powered learning systems can analyse learner performance and recommend personalised learning pathways. Intelligent tutoring systems can provide learners with immediate support and feedback. Although still at

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an early stage in East Africa, some private educational institutions in Kenya have begun experimenting with AI-supported learning platforms to enhance learner engagement and assessment.

Challenges Affecting Technology Integration in CBC

While technology can be leveraged to enhance the implementation of CBC, as discussed in the previous section, Kenya and Uganda face several challenges and barriers in their efforts towards digital learning in CBC, as deliberated in this section.

Infrastructural limitations remain one of the major barriers to effective technology integration in competency-based education within Kenya and Uganda (UNESCO, 2023). Despite the significant opportunities associated with educational technology, inadequate infrastructure, particularly in rural and marginalised areas, remains a major challenge. Many schools lack reliable electricity, internet connectivity, computers, and digital devices. In Uganda, several rural schools continue to rely heavily on traditional teaching methods because of limited technological infrastructure. Similarly, some Kenyan schools struggle with inconsistent internet access and insufficient digital devices for learners.

The digital divide is another barrier. Unequal access to technology can worsen educational inequalities (World Bank, 2022). Learners from affluent urban households often have better access to computers, smartphones, and internet services compared to learners from low-income rural communities. During the COVID-19 pandemic, many learners in remote parts of Kenya and Uganda were unable to participate effectively in online learning because they lacked devices and connectivity. This disparity highlighted the importance of equitable investment in educational technology infrastructure.

Teacher preparedness and resistance to change is also significant challenges in the integration of technology within competency-based education systems (Darling-Hammond et al., 2020). Limited teacher preparedness also poses a serious challenge to technology integration in CBC implementation. Some teachers lack adequate digital literacy skills and confidence in using educational technologies effectively. Others may resist technology adoption because of fear of change or insufficient support. In both Kenya and Uganda, curriculum reforms were introduced rapidly, leading to concerns among teachers regarding preparedness and workload. Continuous professional development is therefore essential for enabling teachers to integrate technology into learner-centred pedagogy successfully.

Financial constraints in the two countries remain a major barrier to technology integration in education systems (African Development Bank, 2021). Procuring computers, tablets, projectors, internet services, and maintenance equipment requires substantial financial investment. Many public schools in Kenya and Uganda operate with limited budgets that make it difficult to sustain digital learning initiatives. Families may also struggle to purchase digital devices for home learning, thereby limiting opportunities for technology-supported education.

Cybersecurity and online safety concerns have also become increasingly important as schools adopt digital technologies (Livingstone & Stoilova, 2021). Learners face risks such as cyberbullying, online exploitation, misinformation, and exposure to inappropriate content. Educational institutions, therefore, require policies and systems that promote responsible digital citizenship and online safety. Governments in both Kenya and Uganda have begun developing policies on digital literacy and cybersecurity awareness within education systems.

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Strategies for Strengthening Technology Integration in CBC

This section provides a discourse of strategies that Kenya and Uganda can employ in order to fully leverage technology for the effective implementation of CBC.

Infrastructure development and connectivity are essential for sustainable technology integration within competency-based education systems (UNESCO, 2022). To address these challenges, governments and stakeholders must adopt comprehensive strategies that promote sustainable technology integration. Investment in infrastructure is particularly important. Schools require reliable electricity, internet connectivity, digital devices, and technical support systems. In remote areas of Kenya and Uganda, solar-powered digital learning centres can help address electricity challenges while supporting access to technology.

Strengthening teacher capacity is essential for the successful implementation of technology-supported competency-based education (Koehler et al., 2022). Teacher capacity building should also be prioritised because teachers are central to successful CBC implementation. Training programs should focus on digital literacy, learner-centred pedagogy, online assessment, and digital content creation. Universities and teacher training colleges in both countries should integrate educational technology and CBC methodologies into pre-service teacher education programs.

Public-private partnerships and stakeholder collaboration can significantly strengthen technology integration efforts within competency-based education systems (Trucano, 2021). Telecommunications companies, technology firms, NGOs, and international organisations can support governments through funding, connectivity services, teacher training, and innovation programs. In Kenya, partnerships between Safaricom, Google, and educational institutions have supported digital learning initiatives and internet connectivity programs. Similar collaborations in Uganda have contributed to ICT training and digital infrastructure development.

Monitoring, evaluation, and quality assurance systems should be strengthened for the purposes of assessing the effectiveness of educational technology initiatives and competency-based curriculum implementation (Fullan et al., 2020). Governments should regularly evaluate learner outcomes, teacher preparedness, infrastructure availability, and digital literacy levels to inform policy decisions and resource allocation. Data-driven approaches can improve accountability and ensure continuous improvement in CBC implementation.

Development of localised digital content is important for ensuring relevance and meaningful learner engagement within competency-based education (Kral, 2021). Educational materials should reflect local cultures, languages, and realities. Kenya Institute of Curriculum Development and Uganda's National Curriculum Development Centre should continue collaborating with educators and technology developers to create culturally relevant digital resources aligned with curriculum goals. Locally produced content enhances learner engagement and contextual understanding.

Future Prospects of Technology and CBC in East Africa

The future of Competency-Based Curriculum in Kenya and Uganda will likely become increasingly dependent on technology as digital transformation continues to shape education globally. Emerging technologies such as artificial intelligence, virtual reality, augmented reality, robotics, and blockchain have the potential to revolutionise teaching, learning, and assessment processes. Virtual reality can provide immersive learning experiences in subjects such as science, geography, and history, while AI can support intelligent tutoring and personalised learning.

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However, successful technology integration requires more than merely providing devices. Educational transformation depends on creating supportive ecosystems involving policy development, teacher empowerment, infrastructure investment, stakeholder collaboration, and sustainable financing. Technology should be viewed as a tool that enhances pedagogy and learner engagement rather than an end in itself.

Recommendations

- Governments in Kenya and Uganda should increase investment in educational technology infrastructure to support the effective implementation of the Competency-Based Curriculum. Schools require reliable electricity, internet connectivity, digital devices, computer laboratories, and technical support systems to facilitate learner-centred and technology-driven instruction.
- Governments should promote equitable access to technology to ensure that all learners benefit from CBC reforms regardless of socio-economic background or geographical location. Subsidised digital devices, affordable internet services, and community digital learning centres can help bridge the digital divide and promote inclusive educational opportunities in Kenya and Uganda. Expanding affordable broadband connectivity and introducing solar-powered digital learning centres can improve access to educational technology in underserved communities
- Teacher training and professional development should also be strengthened to ensure educators possess the digital competencies necessary for CBC implementation. Teachers should receive continuous training in digital pedagogy, online assessment methods, multimedia content creation, and learner-centred instructional approaches. Teacher training institutions in both Kenya and Uganda should integrate educational technology and competency-based methodologies into pre-service and in-service training programs. This would improve teacher confidence and effectiveness in using digital tools within classroom instruction.
- Public-private partnerships should be expanded to mobilise financial resources, technological expertise, and innovation for educational transformation. Telecommunications companies, NGOs, and development partners can support schools through internet connectivity programs, device donations, teacher training, and digital learning initiatives. Partnerships similar to those involving Safaricom and educational institutions in Kenya can help scale technology integration efforts and improve educational access.
- Governments and educational institutions should establish strong monitoring and evaluation systems to assess the effectiveness of technology integration in CBC implementation. Regular evaluation of learner outcomes, teacher preparedness, digital literacy levels, and infrastructure availability can help identify gaps and improve decision-making processes. Evidence-based policies and data-driven planning are essential for ensuring sustainability and accountability in educational technology initiatives.
- Schools should also promote responsible digital citizenship and cybersecurity awareness among learners and teachers. As technology use increases in education, learners must be equipped with skills related to online safety, ethical technology use, and critical evaluation of digital information. Educational institutions should implement policies that protect learners from cyberbullying, misinformation, and online exploitation.

CONCLUSION

Competency-based curriculum represents an important educational reform aimed at equipping learners in Kenya and Uganda with practical skills, critical thinking abilities, creativity, collaboration competencies, and digital literacy

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required in the modern world. Technology has become a key driver in supporting CBC implementation through learner-centred pedagogy, personalised learning, continuous assessment, digital collaboration, and improved access to educational resources. Initiatives such as Kenya's Digital Literacy Programme, mobile learning platforms, ICT teacher training, and Uganda's digital curriculum reforms demonstrate the growing role of technology in transforming teaching and learning. However, challenges, including inadequate infrastructure, unequal access to digital resources, limited teacher preparedness, financial constraints, and cybersecurity concerns, continue to hinder effective implementation. Addressing these barriers requires coordinated efforts among governments, schools, communities, development partners, and private sector organisations through investment in infrastructure, teacher training and equitable technology access. Sustainable and inclusive technology integration can significantly improve educational quality, strengthen learner outcomes, and prepare learners to participate effectively in the global digital economy.

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