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Integrating artificial intelligence into Kenya's competency-based curriculum: A model for ethical, inclusive, and context-aware implementation

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The integration of Artificial Intelligence (AI) into Kenya's Competency-Based Curriculum (CBC) presents both transformative opportunities and complex challenges. This study examines the ethical, infrastructural, and pedagogical implications of AI adoption—focusing on generative and language-based models—in Kenya's education sector, with a particular focus on teacher digital readiness, data governance, and linguistic inclusion. Employing a multi-method qualitative approach, the research combines policy analysis with semi-structured interviews of ten experts, including five public school teachers and five government officials. The findings reveal systemic barriers, including inadequate professional development, fragmented data management frameworks, and the marginalisation of Indigenous languages in AI tools. In response, the study proposes a context-responsive, human-centred model grounded in five pillars: policy and infrastructure reform, teacher capacity-building, local language and cultural integration, participatory design, and equitable learning analytics. This model provides a roadmap for ethically and inclusively integrating AI into CBC implementation, aligning with Kenya's broader goals of equity, innovation, and digital transformation in education.

Keywords: AI, Competency-Based Curriculum, Digital Inclusion

1. Introduction

Artificial Intelligence (AI) is reshaping the global education landscape, enabling personalised learning, real-time assessment, and scalable instructional support (Luckin et al., 2016). In this paper, AI primarily

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refers to generative and language-focused tools, such as Natural Language Processing (NLP), Large Language Models (LLMs), and speech-to-text systems, although broader applications are acknowledged. In Kenya, the rollout of the Competency-Based Curriculum (CBC) marks a significant shift toward learner-centred and skills-based education, emphasising digital literacy, critical thinking, and inclusivity (Kenya Institute of Curriculum Development (KICD), 2017). However, the implementation of CBC has faced substantial challenges, including limited digital infrastructure, insufficient teacher preparation, and fragmented policy support (Karua et al., 2025; Momanyi et al., 2019). Integrating AI into the CBC education system raises significant ethical concerns, including data privacy, algorithmic bias, and linguistic exclusion, which become increasingly pressing. Most AI tools currently deployed in educational contexts predominantly support English and Swahili, excluding the more than 48 indigenous languages spoken across the country (Ondiba, 2025; Amol et al., 2024). This digital marginalisation contradicts CBC's commitment to inclusivity and cultural relevance. Moreover, infrastructural inequalities between rural and urban areas exacerbate disparities in access to AI-supported education (Kiemde & Kora, 2020; Mukuni, 2019).

This study examines the ethical, infrastructural, and policy dimensions of AI integration within CBC. Drawing on a synthesis of Kenya's curriculum policies, the Competency-Based Assessment Framework (Kenya National Examinations Council (KNEC), 2021), national data protection legislation (Government of Kenya (GoK), 2019), and African-centred AI governance research (Ndungi & Siregar, 2023), it identifies key barriers to inclusive and equitable AI adoption. The paper proposes a human-centred, context-responsive model to guide the ethical integration of AI, grounded in teacher capacity-building, linguistic inclusivity, and co-governance, aligned with the CBC's values of equity, innovation, and cultural responsiveness.

1.1 AI ethics, governance, and literacy in education

Recent scholarship highlights three interconnected concerns that shape AI use in education: ethics, governance, and literacy. Ethical debates focus on data privacy, algorithmic bias, and fairness (Huriye, 2023; Luckin et al., 2016). Governance literature emphasises the need for enforceable regulatory frameworks and context-sensitive oversight to bridge the policy-to-practice gap (Ndungi & Siregar, 2023; Nakitare et al., 2024). Finally, studies on AI literacy emphasise that teachers and learners require not only technical familiarity but also awareness of the responsible, transparent, and culturally relevant use of AI (Omoga, 2023). These strands provide a foundation for the proposed model in Section 4, where

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ethical design, participatory governance, and AI literacy are positioned as prerequisites for inclusive CBC integration.

2. Methodology

The study employed a multi-method qualitative design, combining document analysis with semi-structured expert interviews to examine the integration of Artificial Intelligence (AI) into Kenya's Competency-Based Curriculum (CBC). Document analysis focused on national education and ICT policies, curriculum frameworks, and academic literature related to AI ethics, digital equity, and language inclusion. To complement these secondary sources, the study conducted semi-structured interviews with ten key informants: five public school teachers actively engaged in CBC implementation and five government officials involved in education policy, curriculum development, or ICT regulation. Participants were selected through purposive sampling to ensure representation across diverse regions and institutional roles. The interviews provided context-rich, practice-based insights into the challenges and opportunities for integrating AI in Kenyan classrooms. This dual approach enabled a comprehensive understanding of both the policy landscape and lived professional experiences, strengthening the study's ability to propose an informed, context-responsive implementation model.

Data from both policy documents and interview transcripts were analysed thematically. This was guided by three core questions: (1) What structural, pedagogical, and ethical barriers exist to AI integration in the CBC? (2) How are national policies addressing challenges of teacher readiness, data governance, and linguistic exclusion? (3) What opportunities exist for AI to enhance inclusive, learner-centred practices within the CBC framework? Emerging themes from literature and document analysis were triangulated with qualitative insights from expert interviews to validate findings and enrich interpretation. This analytical process enabled the identification of practical and context-sensitive pathways for AI adoption, which were subsequently synthesised into a multi-pillar model for ethical and inclusive integration of AI into Kenya's CBC. Here, AI was treated chiefly in relation to generative and language-based tools most relevant to CBC practice.

3. Systemic challenges to AI adoption in Kenya's CBC

3.1 Teacher digital readiness

While the CBC fosters digital literacy and 21st-century competencies among learners, integrating AI tools into classroom instruction remains a significant challenge, primarily due to gaps in teacher

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readiness and training. The literature consistently points to the limited capacity of teachers to deliver ICT-enhanced lessons that align with CBC goals (Karua et al., 2025; Momanyi & Rop, 2019). These challenges are rooted in inadequate technical training, infrastructural constraints, and limited professional development opportunities, factors that were strongly echoed in the interview data.

Interviews with public school teachers revealed widespread unfamiliarity with AI concepts and tools, even among those actively engaged in CBC implementation. *“Most of us only get general ICT training, nothing about AI or how to use it in class,”* (Public school teacher, Nairobi). Respondents reported that professional development sessions, when available, tended to focus on general ICT use rather than AI-specific applications relevant to learner-centred pedagogies. This observation validates existing studies that criticise the fragmented and unsustainable nature of teacher training programs (Omoga, 2023; Ntorukiri et al., 2022). Several teachers also noted that post-training support was rare and that training content often lacked practical classroom applicability, thereby weakening its impact on teaching practices.

Government officials interviewed corroborated these accounts, acknowledging that while national policies promote digital transformation in education, their implementation is constrained by limited funding, weak county-level coordination, and a lack of structured partnerships with training institutions. These practical barriers have hindered the scaling of CPD programs that can build AI literacy among teachers. This aligns with the literature pointing to the absence of dedicated budgets and incentive structures for teacher capacity-building in Kenya's ICT policy frameworks (Ntorukiri et al., 2022).

A key concern raised during the interviews, and largely underexplored in the existing literature, was the lack of ethical training in continuing professional development (CPD) programs. Teachers and policymakers alike have noted that concepts such as algorithmic bias, accountability, and transparency are often overlooked, despite being crucial to ensuring the responsible use of AI in education. This supports Huriye's (2023) argument that technical readiness must be accompanied by essential digital literacy.

Regional disparities in infrastructure and access to digital tools further compound these challenges. Interviewees from rural and marginalised areas reported having minimal access to internet-enabled devices, which limited their opportunities to engage with digital learning platforms and AI-based resources. These findings reinforce those of Mukuni (2019) and Ndungi & Siregar (2023), who highlight how rural-urban inequalities continue to shape teacher access to digital training and tools. Although learner-focused innovations like M-Shule have gained policy support, there has been comparatively limited investment in AI solutions tailored to teacher development and classroom implementation.

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3.2 Weak data governance

Despite Kenya's enactment of critical data-related legislation, such as the Data Protection Act 2019 and the Open Data Policy 2015, the education sector continues to lack a dedicated framework for managing AI data. Document analysis reveals the absence of a national research data management (RDM) policy to guide the ethical use, storage, and sharing of data in educational settings (Nakitare et al., 2024). This fragmentation is further compounded by reliance on broad ICT policies that fail to address the nuanced demands of AI implementation in schools (Ndungi & Siregar, 2023).

Interviews with policymakers and teachers validated these concerns. Respondents consistently reported that schools operate without clear institutional protocols for anonymising learner data or ensuring data security. This observation aligns with Omoga's (2023) findings on the widespread technical incapacity to enforce data protection at the operational level. Several interviewees noted that staff often lack awareness of legal obligations and best practices for AI-related data use, making compliance with existing laws both complex and inconsistent.

Both documentary sources and interviewees acknowledged the Blockchain and AI Taskforce's policy recommendations as a promising foundation. However, participants noted that these recommendations have not yet been translated into sector-specific, enforceable guidelines tailored to the needs of educational institutions. This policy-to-practice gap has contributed to uncertainty and caution around AI deployment in schools and universities.

Further, the lack of centralised oversight emerged as a key theme. Both literature and interview data noted that the absence of national monitoring and quality assurance mechanisms undermines the uniform application of data governance standards across counties. This decentralisation results in highly uneven practices, with some institutions developing internal protocols while others operate with little to no guidance.

Additionally, the interviews emphasised a critical gap in institutional RDM policies, particularly in higher education. Officials involved in teacher training confirmed that most institutions lack documented procedures for ethical data management, including long-term storage, access control, and informed consent in AI-driven research. These findings reinforce the conclusions of Ndungi and Siregar (2023) and highlight the need for capacity-building among education stakeholders in both legal compliance and technical data handling.

3.3 Linguistic exclusion

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A persistent barrier to the equitable integration of AI in Kenya's education system is the exclusion of Indigenous languages from mainstream Artificial Intelligence (AI) and Natural Language Processing (NLP) tools. Despite the CBC's emphasis on inclusivity and cultural relevance, most AI-supported educational platforms remain heavily skewed toward English and Swahili, reinforcing linguistic inequalities. As highlighted in the literature (Amol et al., 2024), this limited linguistic reach undermines efforts to support diverse learners, particularly those in early education or from rural and Indigenous language communities.

Teachers and policymakers consistently pointed out that the current AI tools available do not reflect the linguistic diversity of Kenyan learners. *“Children in my area speak Dholuo at home, but the digital platforms are only in English and Swahili,”* (Teacher, Homabay, Kenya). Respondents indicated that learners who primarily speak Indigenous languages, such as Dholuo, Suba, Kamba, or Pokot, struggle to engage meaningfully with digital content, as it is often inaccessible in their native languages. This finding aligns with evidence from open-source NLP projects, such as KenCorpus and MasakhaNER, which, although promising, have yet to translate into classroom-ready solutions.

Participants also observed that, although advancements have been made in incorporating more African languages into NLP research, such as through the Building African Voices and the CMU Wilderness project, these efforts are still in the experimental or research phase. Most are not yet mainstreamed into public education tools or policy-supported platforms, limiting their utility in formal schooling. The resulting dominance of English and Swahili reinforces an urban-rural divide in digital learning experiences, marginalising learners whose home languages are not represented digitally.

Moreover, interviewees highlighted a mismatch between the development of ICT infrastructure and language accessibility goals. Current national policies and ed-tech initiatives rarely include provisions for delivering multilingual content despite constitutional commitments to support mother-tongue education. These insights corroborate Ntorukiri et al.'s (2022) findings that ICT investments are rarely language-inclusive, and they reinforce Mandillah's (2019) call for community ownership and participation in the development of mother-tongue education policies.

Notably, both educators and policymakers emphasised the potential of Kenya's devolved system as a vehicle for the bottom-up development of localised AI tools. Counties were identified as strategic platforms through which universities, local developers, and community actors could collaborate on creating culturally and linguistically relevant digital content. However, such collaboration remains aspirational mainly due to a lack of funding, capacity, and institutional support.

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4. Proposed model for AI integration into Kenya's CBC

Building on the identified challenges of teacher digital readiness, weak data governance, and linguistic exclusion, this section outlines a practical and context-sensitive model for the ethical and inclusive integration of Artificial Intelligence (AI) into Kenya's Competency-Based Curriculum (CBC). The model adopts a systems-based approach that connects policy, pedagogy, culture, and community through four interdependent pillars: (1) Policy and Infrastructure Foundation, (2) Teacher-Centric Capacity Building, (3) Local Language and Cultural Integration and (4) Participatory Design and Co-Governance as shown in Figure 1. Each component addresses a critical implementation gap and collectively forms a coherent strategy for ensuring AI contributes meaningfully to CBC's equity-driven learning vision.

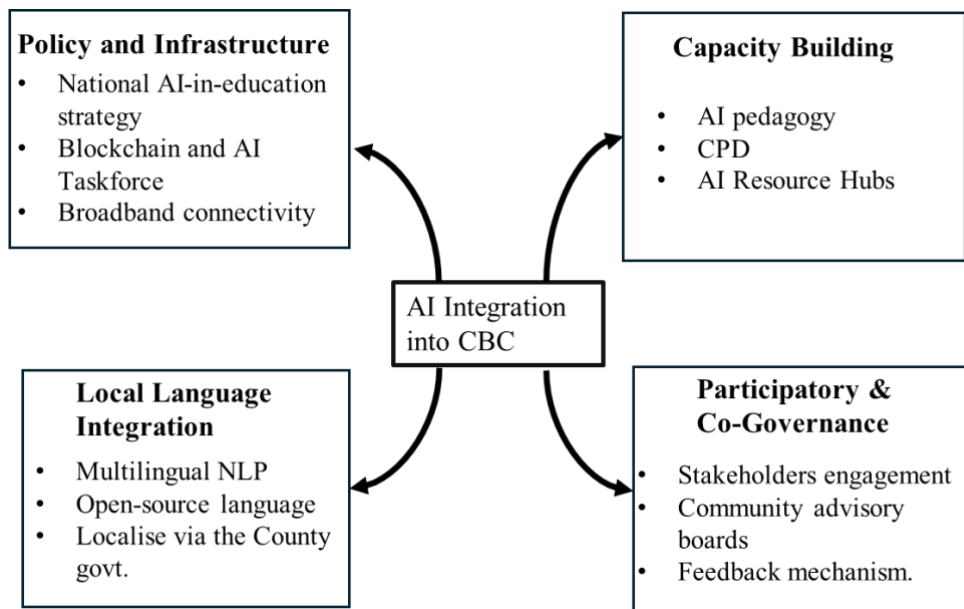


Figure 1: A Flowchart Model of Ethical and Inclusive AI Integration into Kenya's CBC

4.1 Policy and infrastructure foundation

The Ministry of Education should develop a national AI-in-education strategy in collaboration with ICT authorities, regulatory bodies, and academic stakeholders. This strategy must establish enforceable guidelines on algorithmic fairness, data privacy, and accountability, supported by clear implementation protocols explicitly tailored to the education sector.

To strengthen governance, the Ministry should operationalise the recommendations of Kenya's

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Blockchain and AI Taskforce by converting them into sector-specific standards for school-level AI deployment and oversight. In addition, universities and teacher training institutions should adopt institutional Research Data Management (RDM) policies to guide the ethical collection, anonymisation, sharing, and storage of educational data, thereby minimising the legal and ethical risks associated with the use of AI. Establishing a Central AI and Digital Learning Unit within the Ministry would further support the systematic coordination of policy implementation, monitoring, and stakeholder engagement.

Alongside policy reform, infrastructure development is equally critical. The national strategy should allocate targeted funding to expand broadband connectivity, provide affordable digital devices, and invest in solar-powered infrastructure in underserved regions. By aligning legal, technical, and institutional frameworks, this foundation will ensure that AI integration into the CBC is not only innovative and practical but also secure, equitable, and contextually appropriate.

4.2. Teacher-centric capacity building

First, both pre-service and in-service teacher education programs should integrate AI pedagogy by embedding modules on algorithmic literacy, the ethical use of AI, and digital content creation. Comprehensive foundational training is especially critical in underserved regions. To address disparities in access and infrastructure, AI-powered platforms such as M-Shule could be expanded to include teacher-focused, continuous professional development (CPD) modules. These modules should be designed as modular micro-credentials, offering flexibility and allowing educators to build skills incrementally while accommodating their busy schedules.

In addition, the Ministry of Education should establish county-level Teacher AI Resource Hubs, physical or hybrid centres equipped with digital training tools and designed to facilitate peer learning. These hubs would help ensure equitable access to CPD resources, particularly for teachers in rural and marginalised communities.

Finally, the model should include incentive schemes, such as innovation grants or professional recognition awards, to encourage teacher-led experimentation with AI integration. This would elevate educators from passive users to active co-designers and evaluators of AI systems, fostering a sense of ownership, creativity, and long-term sustainability.

4.3 Local language and cultural integration

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First, government and educational institutions must invest in the development of multilingual NLP resources, including crowdsourced corpora, speech-to-text models, and machine translation (MT) tools tailored to local linguistic contexts. These resources should cover underrepresented languages, expanding on the work of initiatives like KenCorpus, MasakhaNER, Building African Voices, and CMU Wilderness.

Second, public funding should be allocated to support the development of open-source language technology in partnership with universities, local linguists, and technology start-ups. These partnerships would enable the co-creation of AI systems that reflect local communication norms, enhance learner engagement, and promote mother tongue education in early grades.

Third, AI systems must be embedded with culturally relevant content to make them meaningful for rural and marginalised learners. This involves not only linguistic translation but also the integration of community narratives, metaphors, and local pedagogical practices into digital content and feedback systems.

Finally, the Ministry of Education should work with county governments to develop and operationalise language accessibility policies in ICT infrastructure planning. Drawing on Kenya's devolved governance structure, local education authorities should be empowered to determine which languages are prioritised in AI applications based on their unique linguistic landscapes. This bottom-up, participatory approach would ensure the inclusion of historically excluded language communities in the AI era.

4.4. Participatory design and co-governance

Participatory design and co-governance are essential to ensuring that AI integration into Kenya's CBC is ethical, responsive, and grounded in local realities. This involves actively engaging educators, learners, parents, developers, and policymakers in the co-design of AI tools, ensuring that diverse voices shape their development and deployment. Community advisory boards should be established to evaluate AI applications in schools, fostering accountability and contextual appropriateness. Additionally, embedding real-time feedback mechanisms within AI systems enables continuous refinement based on user experiences and local values, thereby enhancing trust, relevance, and sustainability in AI-supported education.

5. Conclusion

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This study underscores the urgent need for a context-aware, ethically grounded, and inclusive model for integrating Artificial Intelligence (AI) into Kenya's Competency-Based Curriculum (CBC). The findings reveal that systemic barriers, including inadequate teacher digital readiness, fragmented data governance, and linguistic exclusion, pose significant challenges to the equitable adoption of AI. In response, the proposed model offers a multi-pillar framework centred on policy and infrastructure reform, teacher-centric capacity building, local language and cultural integration, participatory design, and equitable learning analytics. The model encourages a bottom-up, collaborative approach, empowering teachers, communities, and learners to shape AI systems that reflect Kenya's educational priorities and diverse cultural landscape. Future research should explore pilot implementations of this model in diverse school contexts, assess its scalability, and examine the long-term implications of AI on learner outcomes and educational equity.

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