

Framework for Integrating Artificial Intelligence into Primary and Secondary School Curricula in Africa

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Abstract

Artificial Intelligence (AI) is transforming economies and societies worldwide, creating an urgent need for education systems to build foundational AI literacy from the early years of schooling. However, a report by UNESCO shows that while AI curricula have been developed or are in development in various countries, none of these countries are from Africa. This study develops a conceptual framework for integrating AI into primary and secondary school curricula (Grades R–12), equipping students with the knowledge, skills and values required for an AI-driven future. This study is guided by the curriculum development models of Ralph Tyler, Hilda Taba and D.K. Wheeler. The study adopted a scoping review methodology to synthesise literature and propose an AI curriculum framework that defines complementary roles for teachers and AI across five phases. The framework offers practical pathways for embedding AI literacy throughout basic education in Africa.

Keywords: Artificial intelligence; curriculum; Africa; education; primary school; secondary school.

Introduction

The influence of AI technologies is reshaping industries and touching every facet of our daily lives (Cantú-Ortiz et al., 2020). It is widely acknowledged among experts that AI will have far-reaching implications for jobs and education (Cantú-Ortiz et al., 2020). A study by McKinsey suggests that by 2030, a staggering 70% of global businesses will embrace AI (McKinsey Global, 2018). While this presents immense

opportunities, it also raises concerns about widening global inequalities (United Nations Educational, Scientific and Cultural Organisation, 2022). In recognition of AI's transformative power, international policy bodies such as UNESCO emphasise the need for fair and comprehensive application of AI in education. Their guidance advocates for curricula that not only teach AI principles but also prepare students to use AI responsibly (United Nations Educational, Scientific and Cultural Organisation, 2022).

Regrettably, there are few initiatives concentrating on AI education within primary and high school settings. This underscores the imperative for policymakers to establish a conducive environment and educational frameworks that facilitate the teaching of AI skills (Wong et al., 2020; Grassini, 2023).

To address this gap, it is crucial for countries to implement AI curricula in their education systems. However, a UNESCO report shows that although AI curricula have been developed, or are in development, in various countries, none of these countries are in Africa (United Nations Educational, Scientific and Cultural Organisation, 2022; Sanusi et al., 2022).

Methodology

This study employs a scoping review methodology to explore the integration of artificial intelligence (AI) into the educational curriculum across primary and high school (Grades R–12). The study conducted a thorough review of academic literature, official government reports and educational documents to assess the current state of AI education.

The search strategy utilised Google Scholar and employed keywords such as “artificial intelligence education in Grades R–12,” “AI curriculum in primary education,” “AI curriculum in high school education,” and “AI education in Africa.”

The inclusion criteria focused on publications that specifically address AI integration in primary and secondary education. The publication period spanned from 2019 to 2023 to capture recent developments and trends in AI education. Only English-language sources were included.

Findings were synthesised and grouped thematically to provide a clearer perspective on AI integration in Grades R–12. The study acknowledges potential limitations, including language bias (due to English-only inclusion), publication bias (given reliance on published sources) and selection bias (linked to the availability and accessibility of resources). These limitations are acknowledged to ensure transparency regarding the scope and interpretation of the findings.

Literature review

What is Artificial Intelligence?

Artificial intelligence (AI) systems are computing systems with human-like capabilities, including learning, adapting, self-correcting, synthesising and employing data for complex processing of tasks (Heeg & Avraamidou, 2023). AI is composed of machine learning, neural networks and deep learning. Machine learning uses learning algorithms to aggregate data from many sources and spot trends (Heeg & Avraamidou, 2023). Through machine learning, a computer can analyse vast volumes of data to find patterns and create a model that "learns" from the data, as opposed to employing predetermined rules (Heeg & Avraamidou, 2023).

Neural networks are computer systems made up of layers of artificial neurons or linked nodes. These networks are essential to Artificial Intelligence (AI) and machine learning because they can learn from and make judgements based on incoming data (Goel et al., 2023; Khanagar et al., 2021; Xu et al., 2021).

Deep learning is a form of machine learning that employs neural networks to emulate the functionalities of the human brain. Deep learning algorithms that have been trained on large datasets are used to create predictions for tasks like image recognition (Choi et al., 2020; Dargan et al., 2020).

The influence of AI technologies in different sectors.

The growth of AI has ushered in transformative possibilities for various sectors. By harnessing AI-powered solutions, organisations can optimise logistics by analysing data, streamlining routes, predicting demand and managing inventory efficiently (Bharadiya, 2023). In the marketing sector, it can be used to improve inventory-management decisions by predicting demand, forecasting trends in rates of customer purchases and optimising the selection of goods that are available in the store (Sivasankar, 2022). It is also adopted to assess the success of rival campaigns, identify customer expectations, thus providing invaluable insights for marketing plans (Haleem et al., 2022).

In the financial sector, AI has facilitated the efficient analysis of large amounts of financial data to better inform strategic decisions and encourage the development of novel financial products (Cao, 2022). Financial institutions can now examine large financial databases, leading to improved trading techniques and more well-informed investment decisions (Aziz & Andriansyah, 2023; Cao, 2022).

Furthermore, there is a growing adoption of AI in the health sector. AI chatbots have been adopted to provide direct health advice to people experiencing common symptoms (Li, 2023; Matulis & McCoy, 2023; Sun et al., 2022). AI's ability to efficiently manage large datasets generated by smart devices and extract relevant clinical insights is simplifying remote patient monitoring and digital health coaching (Lin, 2022).

AI influence in Education

AI integration in education is transforming the education sector. AI tools can sequence learning materials based on individual student requirements, identifying knowledge gaps or strengths, providing automated feedback and facilitating collaborative learning among students (Baker et al., 2019). In addition, AI has the capability to tailor learning experiences for each student by adjusting to their learning style, pace and preferences. It can analyse student data, including performance, behaviour and interactions with content. This enables it to offer specific recommendations, feedback and interventions. For instance, AI-driven adaptive learning platforms furnish students with personalised learning paths, content and assessments based on their unique needs and progress (Kabudi et al., 2021). These platforms can cater to individual student needs and progress, offering customised learning paths, content and assessments (Kabudi et al., 2021)

Additionally, AI can support educators by automating tasks such as assessment, plagiarism detection, administration and feedback, allowing educators to focus on more strategic aspects of teaching (Zhai, 2022). Furthermore, they provide insights into student progress and support innovative teaching methods (Baker et al., 2019). The insights derived from these tools enable teachers to focus their attention on individual student needs (Baker et al., 2019). Furthermore, they play a crucial role in informing decision-making processes by educational administrators and system-level stakeholders (Baker et al., 2019).

Businesses are embracing AI-based solutions, leading to a rising demand for skills associated with AI use in various industries. As a result, there is a pressing requirement for the education sector to address this rising demand by revising current curricula and redefining policies that support studying artificial intelligence (Pedro et al., 2019).

Education assumes a pivotal role in preparing future workforces for AI readiness. Achieving this goal should involve addressing the AI skills gap, which goes beyond simply adopting increasingly powerful technologies to facilitate learning (Pedro et al., 2019). Countries worldwide are undertaking commendable initiatives to ensure that their education systems nurture the acquisition of skills crucial for a society powered by AI. These efforts can serve as initial benchmarks for developing a collaborative policy framework in response to AI within the education sector (Pedro et al., 2019). This article provides evidence-based recommendations, practical strategies and examples of best practices to help policymakers and educators navigate the complexities of integrating AI education.

Personalised Learning

The purpose of personalised learning AI is to customise the students' learning journey to meet their learning interests and preferences. AI for personalised learning may be used to generate customised lesson plans, suggest educational materials and offer customised feedback. Personalised learning AI focuses on aligning the learning experience with the learner's interests and preference (Kabudi et al., 2021). One way to achieve this is by analysing student data to determine their strong and weak points and adjusting the learning process accordingly. This leads to better learning results and greater student engagement (Zawacki-Richter et al., 2019).

Adaptive Learning

Given that students have diverse ways of perceiving and processing information, adaptive approaches can provide a more supportive learning environment. AI enables adaptive learning through data mining, intelligent tutoring systems, learning analytics and real-time analysis. The goal of adaptive learning is to integrate instruction, practice and assessment within a system that continuously adjusts to students' needs to enhance learning experiences (van der Vorst & Jellicic, 2019). AI-driven adaptive learning systems use algorithms and machine learning to modify the content, pacing and delivery of learning materials in response to students' performance and needs (Martin et al., 2020). These systems can provide personalised feedback, adaptive learning pathways and adaptive assessments aligned to students' progress (Muñoz et al., 2022; Kabudi et al., 2021).

The key distinction is that personalised learning typically aligns learning with students' interests and preferences, whereas adaptive learning adjusts the learning process primarily in response to performance data (Kabudi et al., 2021). Evidence from reviews suggests that adaptive learning technologies can support more responsive teaching and may improve motivation, engagement and academic outcomes when implemented appropriately (Muñoz et al., 2022).

AI can also strengthen accessibility through transcription and translation by generating real-time lesson transcripts and supporting multilingual access to learning materials, which may assist students who face language barriers or hearing difficulties (Owan et al., 2023). In addition, analytics from AI-enabled courseware can be used to examine learning patterns, support interaction in online discussion spaces and help teachers identify at-risk students through dashboard monitoring, enabling timely interventions (Schroeder et al., 2022).

Learning Analytics

Learning analytics (LA) is the systematic approach of measuring, gathering, analysing and reporting data pertaining to students and their contexts. The goal is to gain insights and optimise both the learning process and the environments in which it unfolds (Siemens & Long, 2011).

Learning analytics leverages data from students and learning environments to enhance learning across all levels. While it is still a relatively new field, it has matured significantly, especially when it comes to applications for higher education (Sousa et al., 2021). For example, integrating AI with LA improves overall learning outcomes by providing comments from researchers or professors as well as statistics on how well students are performing (Darvishi et al., 2022). Additionally, students can provide more helpful feedback to their peers and enhance their final performances when AI and LA approaches are employed (Chango et al., 2021).

Tutoring support

Intelligent Tutoring Systems (ITS) enable students to study at home. An ITS is a data-based system that offers students instantaneous, personalised teaching without being limited by time or place, which gives it an advantage over offline tutoring (Cao et al., 2021).

Tutoring AI in education uses artificial intelligence (AI) technologies to provide students with personalised, adaptable support in a range of learning settings (Mousavinasab et al., 2021). AI tutoring systems evaluate student data and provide tailored coaching and feedback according to each student's particular learning requirements (Kim & Kim, 2020). AI enables intelligent tutoring systems to share information about the course subject, recognise students' skills and offer immediate feedback (Zawacki-Richter et al., 2019). It has been shown that ITSs, which guarantee widely accessible, adaptive and personalised learning, are just as successful in improving learning outcomes as human tutoring when compared to more traditional educational approaches (Huang et al., 2021).

AI-Powered Tutoring Support

Tutoring AI in education leverages artificial intelligence technologies to deliver personalised and adaptable support to students across various learning environments (Mousavinasab et al., 2021). These AI tutoring systems analyze student data to provide coaching and feedback that is specifically tailored to each student's unique learning needs (Kim & Kim, 2020). Through intelligent tutoring systems, AI can share information about course topics, identify students' strengths, and offer immediate, individualised feedback (Zawacki-Richter et al., 2019).

Research has demonstrated that intelligent tutoring systems (ITSs) can provide adaptive and personalised learning experiences that are widely accessible. When compared with more traditional educational approaches, ITSs have been shown to be just as effective as human tutors in improving learning outcomes (Huang et al., 2021).

AI Adoption in Administrative Tasks

Recent studies indicate that educators dedicate a significant portion of their working hours between 20 and 40 percent to tasks that could be automated using current technologies (McKinsey Global, 2017). A considerable amount of time is spent on activities such as marking exams, reviewing homework, and providing meaningful feedback to students (Zhai, 2022).

Artificial intelligence offers opportunities to streamline and automate various administrative responsibilities within the educational system. By leveraging AI systems for administrative duties, both educators and school systems can substantially reduce their workloads. For example, AI-powered tools can assist in creating homework assignments, automating grading, and delivering timely feedback on student work, thereby saving valuable time (Owoc et al., 2019).

Additionally, AI technologies enable the creation of timetables and facilitate test scheduling, ensuring that students can attend all their exams without experiencing scheduling conflicts within a semester (Houhamdi et al., 2019). Beyond these tasks, AI also supports educators through automated scheduling, financial processing and management of student enrolment (Zhai, 2022).

Additionally, Artificial intelligence (AI) improves assessment validity and accuracy by examining large datasets, identifying trends and providing insights that are hard for human assessors to get. AI-powered plagiarism detection tools, for example, assess student work and find instances of plagiarism more accurately than human methods (Zawacki-Richter et al., 2019).

Student Support

AI may be utilised to provide support for students who are having emotional or academic difficulties with real-time assistance. This assists educators in creating lesson plans and monitor and mentor pupils using academic data (Zawacki-Richter et al., 2019). This integration of AI allows teachers to identify and address students' needs more effectively, fostering a supportive and responsive educational environment (Zawacki-Richter et al., 2019). For example, chatbots driven by AI may offer students instant assistance and direction. These chatbots use artificial intelligence (AI) to mimic a natural language interaction with users via messaging apps, websites and phone apps (Kooli, 2023). This enables them to be used for administrative duties like helping and guiding students (Fernoagă et al., 2018).

It is acknowledged that chatbot technology responds more quickly than conventional assistance channels (Sandu & Gide, 2019). For example, chatbots were employed to decrease summer melt and offer timely, personalised help to students planning to attend college (Nurshatayeva et al., 2020). Also, the study by Sandu and Gide (2019) found that students perceived chatbots as the fastest and most effective means of communication. Similar research validated chatbots' ability to support students' learning of foundational material in a responsive, engaging and private manner (Chen et al., 2023).

Theoretical models underpinning the study

Curriculum development models

Curriculum is defined as the subjects taught in schools, a specific content area, or a set of materials. Others view it as everything planned by the school or the sum of experiences acquired by students in an educational setting (Marzooghi, 2016).

Despite the diversity of perspectives, there is a continuous attempt to craft a comprehensive and unified definition. Examining these definitions reveals a range of focuses, including student experiences, the development of competencies for adult life, the conceptualisation of curriculum as a system and considerations of the term itself (Coşkun Yaşar & Aslan, 2021).

Various curriculum development models exist. These models are very important for guiding all the planners of education, mentors and administrators. However, in order to produce positive changes, curriculum should be purposeful, planned and progressive (Bhuttah et al., 2019).

Models of Curriculum Development

Curriculum development is a complex process influenced by various theoretical frameworks that guide educators in shaping effective educational experiences. This section discusses prominent models, each contributing unique perspectives to curriculum design.

Ralph Tyler's model for Curriculum Development

Ralph W. Tyler's model of curriculum development, articulated in basic principles of curriculum and instruction (1949), remains one of the most influential frameworks in educational planning (Tyler, 1949). The model is deductive, linear and sequential, moving from general purposes to specific objectives, learning experiences, organisation and evaluation. It is both descriptive and prescriptive, providing a systematic roadmap for curriculum developers that ensures coherence and purpose (Bhuttah et al., 2019).

Firstly, Tyler emphasised that curriculum development must begin with clear educational purposes. These are derived from three primary sources: the learner, society and subject matter (Tyler, 1949). Data gathered from students ensures that objectives reflect developmental needs, interests and behaviours. Data from the society identifies the challenges and demands requiring knowledge, skills and attitudes for effective participation and contribution to social life. Data from the subject matter ensures that the professional knowledge base provides essential disciplinary content. Together, these sources guarantee that objectives are balanced and purposeful.

Secondly, Tyler focused on selecting educational experiences that align with objectives. He proposed that experiences should foster knowledge, skills and attitudes, guided by principles such as relevance, prior knowledge, satisfaction and adequate practice. This ensures that experiences are both meaningful and effective in promoting desired learning outcomes.

Thirdly, Tyler highlighted the need for organising experiences through continuity, sequence and integration, which reinforces learning, build complexity over time and connect ideas across disciplines. This structured organisation enables cumulative and holistic development.

Finally, Tyler emphasised evaluation as central to determining whether purposes have been achieved.

Tyler's rationale is society-centred, positioning the curriculum as a means of refining community life and contributing to societal development. Its enduring strength lies in its systematic and structured approach, which aligns learner needs, social demands and disciplinary knowledge within a coherent curriculum framework.

Hilda Taba's Grassroots Approach

Hilda Taba (1962) advanced a grassroots approach to curriculum development that contrasts with Ralph Tyler's top-down rationale. While Tyler's model begins with institutional goals, Taba argued that curriculum planning should start at the classroom level, with teachers actively diagnosing students' needs and shaping objectives accordingly. By positioning teachers as central agents in curriculum design, Taba's model emphasises contextual relevance, responsiveness and practicality.

Taba outlined seven key steps in her model. The first is the diagnosis of needs, where teachers identify students' requirements, interests and developmental challenges (Taba, 1962). This informs the formulation of objectives, ensuring that goals are closely aligned with learner needs. The next two steps involve the selection and organisation of content, where material must be valid, significant and sequenced according to students' maturity, understanding and interests. Taba then stressed the selection and organisation of learning experiences, requiring instructional methods that engage students actively and help them connect knowledge with experience (Taba, 1962). The final step is evaluation, which involves both teachers and students in assessing whether objectives have been achieved and whether learning has lasting impact. What distinguishes Taba's model is its bottom-up orientation and its emphasis on teacher agency. She believed that curriculum should not be imposed by administrators but developed collaboratively with teachers, who are closest to the students and their contexts.

Tyler's model is deductive, linear and prescriptive, moving from general institutional goals to specific objectives, experiences and evaluation. It reflects a top-down process, in which administrators and policymakers typically set educational purposes before they are translated into classroom practice (Bhutta et al., 2019). By contrast, Taba's model is inductive and grassroots-oriented, beginning with teachers diagnosing learner needs and progressively building objectives, content and evaluation. Unlike Tyler, who saw teachers as implementers of predetermined plans, Taba positioned them as co-creators of the curriculum. This bottom-up emphasis makes her model more flexible, context-sensitive and empowering for teachers, while addressing the dynamic realities of the classroom.

Wheeler's Cyclical Model

Wheeler (1967) advanced a cyclical model of curriculum development that extended Tyler's linear rationale by emphasising curriculum as a continuous and dynamic process. Unlike Tyler, who presented evaluation as the final stage, Wheeler argued that evaluation feeds back into all other stages, making it a central mechanism for ongoing improvement. In this way, the model stresses adaptability, responsiveness and the need for constant revision of curriculum in light of feedback from teachers, students and the educational context (Wheeler, 1967).

Wheeler identified five interrelated stages: aims, goals and objectives; selection of learning experiences; selection of content; organisation and integration of learning experiences and content; and evaluation. These stages are not hierarchical but interconnected, reflecting the cyclical character of curriculum development. For Wheeler, evaluation plays a pivotal role as it enables the comparison of intended outcomes with actual achievements, thereby informing necessary adjustments to objectives, content and pedagogy (Wheeler, 1967).

The strength of Wheeler's model lies in its flexibility and continuity, recognising that curriculum is never static but must evolve with changing knowledge, societal demands and learner needs. By placing content selection as a distinct step alongside learning experiences, Wheeler also highlighted the importance of balance and integration between subject knowledge and pedagogy. However, the model's reliance on detailed situational analysis and continuous revision can be resource-intensive and time-consuming, making it difficult to implement in contexts where efficiency is prioritised.

In comparative terms, Wheeler's model builds on Tyler's systematic clarity and Taba's emphasis on teacher involvement but adds a dynamic cyclical element that promotes sustained improvement and responsiveness. Its enduring significance lies in presenting curriculum development as an iterative process, ensuring relevance and adaptability in ever-changing educational environments.

AI integration in the curriculum framework for primary and secondary school (Grades R-12)

The rapid advancement of artificial intelligence (AI) has created new opportunities and imperatives for transforming education systems. As societies navigate increasingly complex technological landscapes, integrating AI meaningfully into the primary and secondary schools curriculum is essential in preparing students for future work, citizenship and lifelong learning. However, successful integration cannot rely on technology alone. It requires a structured curriculum framework that positions AI not as a replacement for teachers, but as a complementary tool that enhances human expertise.

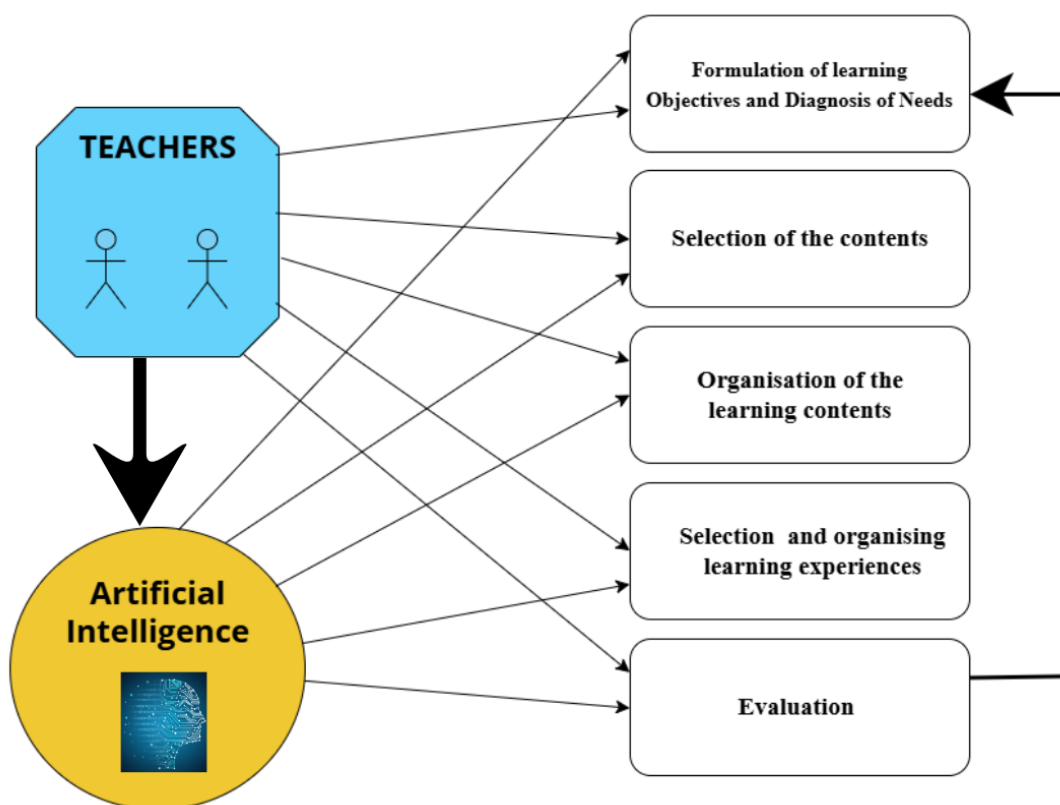


Figure 1: AI integration in the curriculum framework for Grades R-12.

Figure 1 presents the proposed conceptual framework that integrates curriculum development stages adapted from Tyler (1949), Taba (1962) and Wheeler (1967), while aligning AI curriculum content priorities with UNESCO guidance (United Nations Educational, Scientific and Cultural Organisation, 2022). The framework positions teachers and AI as complementary contributors across five phases of curriculum development: (1) objective formulation and needs diagnosis, (2) content selection, (3) content organisation, (4) selection and organisation of learning experiences, and (5) evaluation.

Formulation of learning Objectives and Diagnosis of Needs

Before designing the curriculum, it is essential to identify the needs of students and society. In line with Tyler's model, data can be collected from learners, communities and subject-matter experts. This is followed

by the formulation of learning objectives, which are pursued through teaching and learning activities facilitated by teachers and supported by appropriate AI tools.

- ***Role of Teachers***

Teachers play a critical role by bringing classroom realities, cultural values and community needs into the objectives. They may also advocate for learner-centred goals that include socio-emotional growth and ensure that objectives reflect ethical and developmental priorities.

- ***Role of AI***

In line with recommendations from the United Nations Educational, Scientific and Cultural Organisation (2022), this framework suggests that AI can be used to analyse national and international datasets to identify skills gaps and benchmark objectives against global standards. AI can also support predictive modelling to simulate curriculum outcomes and automate the collection and analysis of stakeholder surveys. These outputs can guide the development of curriculum objectives that address current and future national needs.

Selection of the learning contents

Once the objectives of the curriculum have been identified, the content is developed. Content and objectives should not only correspond to one another but also be valid and significant. UNESCO proposes the development of AI curriculum content that covers algorithms and programming, understanding data, solving problems in context, ethical considerations and broader societal impacts, as well as diverse applications of AI (United Nations Educational, Scientific and Cultural Organisation, 2022).

- ***Role of Teachers***

This framework suggests that at this stage, teachers can create culturally appropriate, inclusive and ethical content. In addition, they can validate resources to prevent misinformation or bias. Furthermore, teachers can integrate indigenous knowledge and local priorities.

- ***Role of AI***

At this stage, artificial intelligence can be used to auto-generate textbooks, lesson plans and multimedia resources. In addition, AI can be used to update content dynamically with new global knowledge. In line with Tyler's view of ensuring that curriculum objectives reflect developmental interests and behaviours of students, artificial intelligence can facilitate the delivery of personalised learning materials aligned with learner profiles. Furthermore, it can be used to flag bias in proposed content using AI detection models.

Organisation of the learning contents

In this stage, there is a need for a purposeful alignment between educational goals, content, instructional methods and assessment.

- ***Role of Teachers***

Teachers sequence topics logically for developmental readiness and build interdisciplinary coherence relevant to local contexts. Furthermore, teachers may advocate for inclusive pacing to support weaker students.

- ***Role of AI***

Artificial intelligence may recommend optimal sequencing based on learning analytics and AI can be used to automate timetabling and resource allocation. This allows for a more sustainable curriculum. Furthermore, AI can use data mining to map cross-subject links.

Selection and organising learning experiences.

At this stage, instructional methods should be selected to engage students with the content. This phase focuses on designing learning experiences that align with both curriculum content and behavioural/skill

outcomes. Effective learning experiences require adequate prior knowledge, student satisfaction, alignment with objectives, opportunities for practice and recognition that a single activity may produce multiple learning outcomes.

- ***Role of Teachers***

In AI education, project-based learning and activity-based learning are widely used approaches. They foster teamwork and enable students to tackle complex challenges collaboratively, while hands-on learning supports practical skill development (United Nations Educational, Scientific and Cultural Organisation, 2022). At this stage, teachers may facilitate experiences fostering critical thinking, collaboration and ethics and adapt activities based on classroom dynamics. Also, teachers can mentor students through project- and activity-based learning. Teachers should connect experiences with curriculum content meaningfully and facilitate reflective dialogue linking classroom work to real-world issues.

- ***Role of AI***

Artificial intelligence can be adopted to deliver adaptive learning systems that adjust in real time. It can also provide personalised pathways for individual students, allowing them to match the learner's interests and preferences with the learning process. Additionally, AI can offer intelligent tutoring systems and simulations that analyse student data and provide tailored coaching and feedback based on each student's specific learning requirements. This also supports gamified and experiential learning opportunities. AI can be adopted to match content with optimal experiences through analytics. Furthermore, AI can be adopted to automate scheduling and cross-subject integration.

Evaluation

A robust system for continuous evaluation and feedback should be implemented to assess the efficacy of AI curricula. Evaluation can highlight weaknesses and strengths of the curriculum, support refinement, and compare actual outcomes with expected outcomes.

During evaluation, AI and teachers contribute distinct but complementary roles. AI can aggregate large-scale analytics, apply predictive models to identify at-risk students and automate dashboards, while teachers observe classroom behaviours, monitor socio-emotional development, and gather qualitative insights from students and parents, including contextual issues not captured in quantitative data.

In curriculum refinement, AI can suggest changes to content sequencing, optimise adaptive learning pathways and simulate integration models. Teachers apply professional judgement to adjust objectives for local realities and values.

During implementation adjustments, AI can deliver real-time personalised feedback and generate revised resources which may include quizzes and lesson plans. Teachers trial strategies, monitor learner responses, and connect content to lived experiences and community realities. As a new cycle begins, AI supports feedback into the system, while teachers advocate for systemic change through policy input, institutional culture and aligned professional development. Together, AI and teachers support a dynamic evaluation ecosystem balancing technology-driven insights with human judgement, empathy and contextual awareness.

Conclusion

The transformative impact of artificial intelligence (AI) on industries worldwide necessitates a proactive and comprehensive approach to AI education, particularly within primary and secondary schooling. Findings indicate a significant gap in the current curriculum, with limited AI integration and minimal dedicated hours, hindering students from attaining essential AI skills.

One of the challenges in the existing curriculum regarding AI is the lack of dedicated courses or modules specifically focused on AI in Africa. The curriculum primarily focuses on traditional subjects and AI is not yet recognised as a standalone subject in the curriculum. This limits the depth and breadth of AI education provided to students. As a result, many students go through primary and high school without sufficient knowledge and skills in AI, which are increasingly essential in today's digital era. The article advocates for the development of a standalone AI curriculum, addressing not only technical aspects but also cultural inclusivity, accessibility and ongoing evaluation. Collaboration between educators, industry experts and policymakers is paramount to successfully bridge the existing gaps. As we envision an AI-driven future, the education system must evolve to equip students with the knowledge and skills required for success. Through early childhood education that embraces the teaching of AI, Africa has an opportunity to lead in this transformation by adopting a forward-thinking AI curriculum that prepares its youth for the challenges and opportunities of the digital era.

Declarations

Competing Interests

VM is an editor for this journal and was removed from all editorial decisions relating to the processing of this paper. The author declares no other competing interests.

Author Contributions

VM conceptualised the study, conducted the scoping review, synthesised the literature, developed the conceptual framework, and drafted and revised the manuscript.

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Data Availability Statement

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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