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Reimagining Curriculum Implementation in Tertiary Institutions in the Era of Artificial Intelligence

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Abstract: Curriculum implementation is a critical process through which the objectives, contents, learning experiences and assessment strategies contained in an approved curriculum are translated into practical teaching and learning activities in tertiary institutions. In many Nigerian tertiary institutions, however, curriculum implementation has continued to rely substantially on manual practices, including physical preparation of instructional materials, face-to-face dissemination of information, manual attendance and record keeping, conventional classroom instruction, paper-based assessment, physical submission of assignments and predominantly teacher-centred pedagogical approaches. Although these practices have supported tertiary education for many years, they are increasingly challenged by large student populations, inadequate infrastructure, shortage of instructional resources, limited funding, inadequate digital competencies among lecturers, unreliable electricity and internet connectivity, bureaucratic procedures, overcrowded classrooms and changing labour-market demands. The emergence of artificial intelligence (AI) provides opportunities to transform these practices through personalised learning, intelligent tutoring, AI-assisted instructional preparation, digital assessment, data-driven curriculum monitoring, research support and improved access to learning resources. This paper therefore examines the reimagining of curriculum implementation in tertiary institutions in the era of AI. It argues that AI should complement rather than replace lecturers and should be implemented within a human-centred, ethical and inclusive framework. The paper recommends investment in digital infrastructure, continuous professional development of lecturers, integration of AI literacy across disciplines, development of institutional AI policies, flexible curriculum review and equitable access to AI-enabled educational resources.

Keywords: Artificial Intelligence, Curriculum Implementation, Tertiary Institutions, Digital Education, Curriculum Transformation

1. Introduction

Tertiary institutions constitute an important component of the education system because they are responsible for producing highly skilled human resources, advancing knowledge through research and contributing to national development. Universities, polytechnics, colleges of education and other post-secondary institutions implement approved academic programmes through curricula that specify educational objectives, subject content, learning experiences, instructional strategies and assessment procedures. The effectiveness of these institutions therefore depends not only on the quality of curriculum design but also on the extent to which the curriculum is effectively implemented. Curriculum implementation refers to the process of putting an approved curriculum into practice through the interaction of lecturers, students, instructional

materials, facilities, assessment procedures and institutional structures. It is the stage at which curriculum intentions are translated into actual teaching and learning experiences. In tertiary institutions, effective implementation requires qualified lecturers, adequate instructional resources, functional infrastructure, appropriate teaching methods, effective assessment and an institutional environment that supports learning. UNESCO notes that artificial intelligence is already influencing teaching, learning, assessment, research and other functions of higher education, making it necessary for institutions to reconsider existing educational practices [1].

For many years, curriculum implementation in Nigerian tertiary institutions has been predominantly manual. Although digital technologies have increasingly been introduced, several academic and administrative activities continue to depend heavily on traditional procedures. Manual instructional preparation and delivery remain common. Lecturers traditionally prepare lecture notes, write lesson plans, develop course outlines and produce teaching materials manually before presenting them through face-to-face classroom instruction. The lecturer is often the principal source of knowledge, while students listen, take notes and reproduce the information during examinations. Although face-to-face teaching remains valuable, excessive dependence on teacher-centred approaches can limit opportunities for personalised and interactive learning. Paper-based assessment remains an important component of curriculum implementation. Students may receive printed examination questions, write answers in examination booklets and submit physical assignments. Lecturers subsequently mark scripts manually and record results. Such processes can consume considerable time, particularly where institutions have large student populations. AI and digital technologies provide opportunities to automate some routine processes while allowing lecturers to concentrate more on higher-order assessment and feedback [2].

Manual record keeping and academic monitoring continue to be used in many institutions. Attendance records, continuous assessment scores, examination results, course registration information and other academic records may involve substantial paper documentation. Manual systems can make information retrieval slower and may increase the possibility of errors, duplication and loss of records. Physical distribution of learning resources is another traditional practice. Students may depend heavily on printed textbooks, handouts, lecture notes and photocopied materials. While printed resources remain important, digital repositories, learning-management systems and AI-supported search and learning tools can expand students' access to relevant educational materials [3].

Manual curriculum monitoring and evaluation can limit the speed with which institutions identify implementation gaps. Academic departments and institutional quality-assurance units may depend heavily on meetings, physical reports and periodic reviews to determine whether courses are being taught according to approved curriculum requirements. AI-supported analytics could provide institutions with more timely information about student performance, course completion, learning gaps and other indicators. Manual implementation is therefore not inherently ineffective, but its limitations become more visible as student populations increase and the knowledge economy becomes increasingly digital and AI-driven.

Several challenges constrain the effective implementation of curriculum through predominantly manual approaches.

The expansion of tertiary education has increased student enrolment in many institutions. Large classes make it difficult for lecturers to provide individualised attention, monitor students continuously and give timely feedback [4]. AI-supported adaptive learning systems could help address some of these challenges by providing differentiated learning activities and immediate feedback while maintaining the lecturer's central role. Inadequate classrooms, laboratories, libraries, computers, internet facilities and other instructional resources constitute major barriers to effective curriculum implementation. The transition from manual to AI-supported curriculum implementation will require

reliable electricity, broadband connectivity, appropriate devices, digital platforms and secure data systems.

Effective curriculum implementation requires sustained financial investment. Limited institutional funding can affect the procurement of instructional materials, maintenance of facilities, staff development and acquisition of digital technologies. AI adoption without adequate funding may therefore increase inequalities between institutions with strong technological capacity and those with limited resources. The successful integration of AI depends substantially on the capacity of lecturers to use emerging technologies appropriately. UNESCO's AI Competency Framework for Teachers identifies competencies involving AI foundations and applications, AI pedagogy, ethics and professional learning (Miao & Cukurova, 2024). Without systematic staff development, lecturers may lack the confidence and competence required to integrate AI into curriculum implementation [5], [6].

Some lecturers, administrators and students may resist changes to established educational practices because of limited knowledge, fear of technology, concerns about employment or preference for familiar methods. Effective transformation therefore requires institutional leadership, awareness programmes, consultation and professional support rather than simply introducing new technologies. AI-supported curriculum implementation depends heavily on reliable electricity and internet access. In contexts where electricity supply is unstable or internet connectivity is expensive or unreliable, lecturers and students may experience difficulties accessing AI platforms, online libraries and digital learning environments. This remains an important consideration for Nigerian tertiary institutions [7].

The challenges associated with predominantly manual curriculum implementation provide a strong justification for rethinking educational practices. AI can support personalised learning, intelligent tutoring, curriculum monitoring, assessment, research, content development and academic advising. Zawacki-Richter et al. found that AI applications in higher education have been used in areas including assessment and evaluation, adaptive systems, student profiling and prediction, and intelligent tutoring.

2. Materials and Method

Conceptual Terms

Concept of Tertiary Education

Tertiary education is an important level of the education system that follows secondary education and provides advanced academic, professional and vocational learning. The following definitions present the concept from different scholarly and institutional perspectives. UNESCO Institute for Statistics (UIS) defines tertiary education as education that builds on secondary education and provides learning activities in specialised fields, with learning taking place at a high level of complexity and specialisation. It includes both academic education and advanced vocational or professional education. Under ISCED 2011, tertiary education comprises Levels 5–8. UNESCO describes tertiary education as the level of education that follows secondary schooling and encompasses programmes provided by universities, colleges and vocational institutions. Its major purpose is to develop specialised knowledge and skills that prepare individuals for professional careers or further advanced studies.

According to the International Standard Classification of Education, tertiary education consists of four levels: short-cycle tertiary education (Level 5), Bachelor's or equivalent education (Level 6), Master's or equivalent education (Level 7), and doctoral or equivalent education (Level 8). These programmes progressively provide professional, academic and research competencies at increasingly advanced levels. Tertiary education can therefore be operationally defined as organised post-secondary education provided by universities, polytechnics, colleges and other recognised higher-education institutions for the acquisition of advanced academic, professional, vocational and research knowledge,

skills and competencies. This definition is consistent with the UNESCO/ISCED classification, which recognises tertiary education as specialised education beyond secondary schooling. From these definitions, tertiary education can be understood as more than simply education after secondary school. It is a specialised level of education concerned with advanced knowledge production, professional preparation, research, innovation and human-capital development. In the context of Nigeria, it encompasses different categories of institutions and programmes designed to prepare learners for employment, professional practice, research and contribution to national development.

Concept of Curriculum Implementation

Curriculum implementation is the process through which an approved or intended curriculum is translated into actual teaching, learning and assessment activities. It represents the practical stage at which curriculum objectives, contents, instructional strategies and assessment procedures are put into operation. UNESCO defines the implemented curriculum as the actual teaching and learning activities that take place through interactions between learners and educators. It represents the process through which the intended curriculum is translated into practice and delivered to learners. Fullan and Pomfret conceptualise curriculum implementation as a complex process concerned with how an educational innovation or curriculum is actually put into practice. Their influential review emphasises that implementation involves examining the extent to which intended curriculum practices are actually used rather than simply determining whether a curriculum has formally been adopted.

Curriculum implementation may be understood as the process through which an officially designed course of study is translated into syllabuses, schemes of work, lessons and actual classroom teaching. From this perspective, lecturers or teachers are central actors because the curriculum becomes operational through their interaction with learners and instructional resources. Recent curriculum research similarly describes implementation as the translation of an officially designed course of study into actual teaching and learning. Curriculum implementation can also be defined as the process of putting a new or modified curriculum into practice and examining how it functions in the educational setting. This perspective regards implementation as an ongoing and interactive process involving educators, learners, institutional leadership, resources, professional development and contextual factors. Research drawing on the curriculum-implementation framework of Rogan and Grayson (2003), for example, identifies implementation as being influenced by institutional capacity, external support and what actually occurs in practice.

Based on the foregoing definitions, curriculum implementation in tertiary institutions can be defined as the systematic process of translating an approved academic curriculum into actual teaching, learning, assessment and other educational activities through the coordinated efforts of lecturers, students, administrators and other stakeholders, supported by appropriate resources, facilities and institutional policies. This definition is particularly relevant to tertiary institutions because curriculum implementation does not occur only inside the classroom. It encompasses course delivery, practical activities, laboratory experiences, assessment, academic advising, research activities, use of instructional resources and monitoring of learning outcomes. In the contemporary context, it also increasingly includes digital technologies and artificial intelligence-supported teaching and learning.

3. Results

Reimagining Curriculum Implementation in Tertiary Institutions in the Era of Artificial Intelligence

The emergence of artificial intelligence (AI), particularly generative AI, is transforming the knowledge, skills, pedagogies and competencies required of graduates. Consequently, curriculum implementation in tertiary institutions can no longer depend

entirely on conventional content delivery. Universities, polytechnics and colleges need to redesign implementation practices so that students acquire not only disciplinary knowledge but also AI literacy, critical thinking, ethical judgement, creativity and the capacity to work effectively with intelligent technologies. UNESCO emphasizes that AI has implications for curriculum design, teaching, learning, assessment, research and the future of work [8].

Integrating AI Literacy and Digital Competencies Across the Curriculum

Curriculum implementation should be reimaged by making AI literacy a cross-cutting competency across disciplines, rather than restricting AI education to computer science and engineering programmes. Students of education, medicine, agriculture, law, economics, social sciences, humanities and management should understand the basic principles, applications, limitations and implications of AI within their respective disciplines. AI literacy should include knowledge of algorithms, data, machine learning, generative AI, prompt formulation, verification of AI-generated information, digital citizenship and responsible human-AI interaction. UNESCO recommends that higher education institutions develop courses and skills training relevant to the AI era, while also ensuring that critical thinking is cultivated across courses. Thus, curriculum implementation in Nigerian tertiary institutions should move from “learning about technology” to “learning with, through and about AI.” For example, students of educational management can use AI for data analysis and educational planning; medical students can examine AI-assisted diagnosis; agricultural students can explore precision agriculture; while law students can investigate AI, intellectual property and data protection [9]. This approach would make graduates more relevant to contemporary workplaces.

Reorienting Teaching and Learning Towards AI-Supported Personalised Learning

AI provides opportunities for tertiary institutions to move from predominantly teacher-centred instruction towards personalised, adaptive and learner-centred education. AI-powered systems can analyse students' learning patterns, provide immediate feedback, recommend learning resources and identify areas where individual learners require additional support. Zawacki-Richter et al. in a systematic review of AI applications in higher education, identified applications involving assessment and evaluation, adaptive systems, profiling and prediction, intelligent tutoring systems and other educational processes. Their review demonstrates the growing potential of AI to support teaching and learning in higher education. Curriculum implementation should therefore provide opportunities for lecturers to use AI-supported learning platforms alongside conventional classroom interaction. A lecturer could, for example, use AI tools to generate differentiated learning activities for students with different levels of prior knowledge, while students could use intelligent tutoring systems to receive additional explanations outside normal classroom hours [10]. AI should augment rather than replace lecturers. UNESCO stresses that AI should empower teachers rather than substitute for them and that educators require appropriate capacity-building to work effectively alongside AI systems.

Transforming Curriculum Content to Emphasise Critical Thinking, Creativity and Problem-Solving

The widespread availability of generative AI requires tertiary institutions to reconsider what students are expected to learn and how learning outcomes are formulated. If students can use AI to produce essays, summaries, computer code and other conventional academic outputs, curriculum implementation should place greater emphasis on higher-order cognitive competencies that require students to analyse, evaluate, create, justify and solve authentic problems. Kasneci et al. explain that large language models such as ChatGPT present educational opportunities but also create challenges relating to accuracy, bias, critical engagement and the changing nature of learning [11]. Assessment and classroom activities should require students to demonstrate how they arrived at conclusions rather than merely submit finished products. Students

could be asked to critique an AI-generated answer, identify inaccuracies, compare alternative solutions, defend their position with scholarly evidence or apply AI-generated ideas to a real Nigerian problem. This represents a shift from content reproduction to knowledge construction and problem-solving. Curriculum implementation should consequently prioritise project-based learning, case studies, collaborative problem-solving, research projects, simulations and community-based assignments. Such an approach would make tertiary education more responsive to the changing demands of the AI-driven economy.

Reimagining Assessment and Protecting Academic Integrity

AI requires tertiary institutions to reconsider traditional assessment practices. Conventional take-home essays and unsupervised assignments can be produced substantially with generative AI, making it increasingly difficult to determine whether submitted work reflects the student's independent knowledge and skills [12]. Cotton, Cotton, and Shipway (2024) identified academic honesty and plagiarism as important concerns associated with ChatGPT in higher education and recommended proactive institutional policies, training, support and appropriate approaches to preventing academic dishonesty. Curriculum implementation should therefore incorporate AI-aware assessment strategies. These may include oral examinations, supervised practical tasks, project demonstrations, portfolios, reflective journals, presentations, problem-based assessments and viva voce examinations. Students can also be permitted to use AI under clearly defined conditions, provided they disclose how it was used and critically evaluate its output. The objective should not simply be to prohibit AI. Instead, institutions should develop clear policies distinguishing acceptable, restricted and unacceptable AI use. This approach would promote academic integrity while also preparing students for workplaces where human professionals increasingly collaborate with AI systems [13].

Building Ethical, Inclusive and Future-Oriented Curriculum Implementation

A major dimension of reimagining curriculum implementation is ensuring that AI adoption does not deepen existing educational inequalities. Differences in access to computers, reliable electricity, internet connectivity, digital skills and AI tools may create new forms of inequality among students and institutions. UNESCO (2023) warns that AI in education raises concerns relating to equity, inclusion, gender equality, privacy, cultural and linguistic diversity, bias and human agency. It therefore advocates a human-centred approach to AI implementation. Tertiary institutions should consequently embed AI ethics, data privacy, algorithmic bias, responsible innovation, digital citizenship and human rights into curriculum implementation. Students should understand that AI systems are not necessarily neutral and that AI-generated outputs can contain errors, biases and misleading information. For Nigerian tertiary institutions, this should also involve contextualising AI education to local realities [14]. Curriculum implementation should encourage students to develop AI-supported solutions to Nigerian challenges in education, healthcare, agriculture, governance, environmental management and entrepreneurship. Institutions should also provide equitable access to digital infrastructure and develop lecturers' capacity to use AI responsibly. A future-oriented curriculum should therefore produce graduates who are not merely users of AI, but critical, ethical and creative co-creators capable of using AI to address societal problems. UNESCO's higher-education guidance similarly recommends building institutional capacity, developing AI policy frameworks, innovating pedagogy and skills training, promoting AI research and improving inclusion.

Strengthening Continuous Professional Development for Lecturers

Curriculum implementation in the AI era requires lecturers to continuously update their knowledge, pedagogical skills and technological competencies. It is no longer sufficient for lecturers to possess expertise only in their academic disciplines; they also need to understand how AI can support teaching, assessment, research and student engagement. UNESCO's *AI Competency Framework for Teachers* identifies competencies

relating to a human-centred mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning [15]. This implies that tertiary institutions should institutionalise regular workshops, seminars, communities of practice, short courses and professional certification programmes on AI-supported pedagogy. For Nigerian tertiary institutions, staff development programmes should expose lecturers to responsible use of generative AI, AI-assisted lesson preparation, intelligent tutoring systems, automated feedback, data analytics, AI-supported research and appropriate methods of evaluating AI-assisted student work. Continuous professional development will ensure that curriculum implementation remains relevant as AI technologies evolve.

Promoting Interdisciplinary and Multidisciplinary Curriculum Implementation

AI is not confined to computer science; it increasingly influences virtually every professional and academic discipline. Consequently, tertiary institutions should move from rigid disciplinary boundaries towards interdisciplinary curriculum implementation in which students from different fields collaborate to solve complex problems using AI. UNESCO's higher-education primer identifies AI's implications for learning, teaching, assessment, research, administration and the labour market, demonstrating that AI is a cross-cutting issue rather than the concern of one academic discipline. Similarly, UNESCO's AI competency framework emphasises connecting AI knowledge with real-world challenges and developing students' critical problem-solving and creative capacities. Therefore, universities could establish interdisciplinary courses such as AI and Education, AI and Healthcare, AI and Sustainable Development, AI and Entrepreneurship, AI and Public Administration, and AI Ethics and Society. Such curriculum implementation would enable students to combine disciplinary knowledge with technological and problem-solving competencies.

Integrating AI into Research-Based Learning and Innovation

Curriculum implementation should increasingly connect classroom learning with AI-supported research, innovation and problem-solving. Students should be trained to use AI responsibly in literature discovery, data organisation, statistical analysis, modelling, coding, simulation and research communication while maintaining appropriate scholarly standards. UNESCO identifies AI-powered research tools and research on AI as important dimensions of AI in higher education. The organisation also highlights the potential of AI to support research addressing the Sustainable Development Goals. Tertiary institutions should redesign research methods courses and project-based learning to include responsible AI applications. Students could, for example, use AI-assisted data-analysis tools to investigate educational challenges, environmental problems, agricultural productivity or public-health issues. However, curriculum implementation should require students to verify AI-generated information, acknowledge AI assistance where appropriate and retain responsibility for the integrity of their research. This approach would transform students from passive consumers of knowledge into researchers, innovators and problem-solvers.

Developing Flexible and Future-Proof Curriculum Structures

The rapid development of AI makes it difficult for rigid curricula to remain relevant for long periods. Curriculum implementation should therefore become more flexible, adaptive and future-oriented. Institutions should periodically review course contents, learning outcomes and teaching strategies to ensure that programmes respond to emerging technological, economic and societal changes. UNESCO's AI competency framework stresses the need for future-proofing and locally feasible curriculum domains, while also recommending progressive development of competencies rather than one-time exposure to AI. Tertiary institutions should therefore establish mechanisms for annual or periodic curriculum review involving lecturers, students, employers, professional bodies, industry experts and technology specialists. Courses that have become obsolete should be revised, while emerging areas such as generative AI, data science, robotics, cybersecurity, AI ethics and digital entrepreneurship should be incorporated where relevant. For Nigeria,

such flexibility is particularly important because tertiary institutions must prepare graduates for both existing occupations and emerging employment opportunities.

Creating Human-Centred and Ethical AI Curriculum Implementation

The final dimension is to ensure that AI does not undermine the human purpose of tertiary education. Curriculum implementation should place human values, ethics, accountability, inclusion, privacy, fairness and human judgement at the centre of AI adoption. UNESCO's *Recommendation on the Ethics of Artificial Intelligence* identifies human rights and dignity as foundational principles and emphasises transparency, fairness and human oversight in AI systems. UNESCO's AI competency framework similarly identifies a human-centred mindset and AI ethics as fundamental dimensions of AI competence. Tertiary institutions should incorporate AI ethics into curriculum implementation across disciplines. Students should learn about algorithmic bias, privacy, data protection, intellectual property, misinformation, discrimination, responsible AI use and the limits of machine-generated decisions. The objective should not be to produce graduates who simply know how to operate AI tools, but graduates who know when, why and when not to use AI. Such an approach will ensure that technological advancement remains subordinate to human dignity, professional responsibility and societal development.

4. Conclusion

Curriculum implementation is central to the achievement of the goals of tertiary education because it transforms curriculum intentions into actual learning experiences. However, heavy dependence on manual approaches has created challenges involving large student populations, inadequate infrastructure, limited resources, slow assessment processes, ineffective record management, inadequate individualised learning and difficulties in curriculum monitoring. The rapid development of artificial intelligence presents an opportunity to address some of these challenges and transform curriculum implementation. Reimagining curriculum implementation does not mean eliminating conventional teaching or replacing lecturers with machines. Rather, it means creating a balanced educational system in which lecturers combine professional judgement, human interaction and disciplinary expertise with appropriate AI-enabled tools. AI can support personalised learning, assessment, curriculum monitoring, research, instructional preparation and student engagement. Nevertheless, its implementation must be ethical, inclusive, secure and sensitive to the Nigerian educational context. Based on the findings, the study recommends the followings: Tertiary institutions should develop comprehensive AI-in-education policies that clearly define acceptable, restricted and unacceptable uses of AI by lecturers, students and administrators. Government and institutional authorities should invest in digital infrastructure, including reliable electricity, broadband internet, computers, smart classrooms, learning-management systems and secure digital repositories. Regular AI professional-development programmes should be organised for lecturers. Training should cover AI literacy, AI-supported pedagogy, assessment, research, ethics, data protection and responsible use of generative AI. AI literacy should be integrated across tertiary education curricula. Every graduate should possess basic knowledge of AI, critical evaluation skills, ethical awareness and the ability to use relevant AI tools within his or her discipline. Assessment practices should be redesigned. Institutions should increase the use of oral examinations, project-based assessment, portfolios, presentations, practical demonstrations and supervised assessments alongside appropriately regulated AI-assisted assignments. Curriculum review should become more flexible and continuous. Institutions should periodically review academic programmes to ensure that their contents and learning outcomes remain relevant to technological and labour-market developments. Equitable access to AI technologies should be promoted. Government and institutions should ensure that students from disadvantaged backgrounds are not excluded from AI-enabled learning because of inability to afford devices, internet access or relevant software. AI ethics and academic integrity should be strengthened. Students and lecturers should be taught about

misinformation, algorithmic bias, privacy, intellectual property, plagiarism, responsible AI use and human accountability. Tertiary institutions should promote interdisciplinary AI projects and research. Students and lecturers from different disciplines should collaborate to apply AI to Nigerian challenges in education, healthcare, agriculture, governance, environmental sustainability and entrepreneurship. AI implementation should remain human-centred. Lecturers should retain responsibility for academic judgement, student mentorship, curriculum interpretation and quality assurance, while AI should serve as a supportive instrument for improving teaching, learning and institutional effectiveness.

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