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PERSPECTIVE ON TERTIARY EDUCATION IN NIGERIA

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CHAPTER FIVE

ARTIFICIAL INTELLIGENCES DEPLOYMENT IN TERTIARY EDUCATION

By

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Abstract

Artificial Intelligence (AI) is transforming global higher education by reshaping teaching, research, and community engagement. This chapter explores the deployment of AI in tertiary institutions with specific emphasis on the Nigerian context. It clarifies key concepts, outlines the imperative of integrating AI into higher education, and discusses its applications in teaching, research, and community service. AI technologies such as Intelligent Tutoring Systems, automated grading, plagiarism detection, predictive analytics, and adaptive learning platforms enhance teaching and learning by supporting personalized instruction, improving efficiency, and promoting academic integrity. In research, AI facilitates advanced data analytics, literature reviews, recommendation systems, and collaboration, accelerating knowledge creation and innovation. Community service initiatives also benefit from AI through improved needs assessment, resource allocation, and data-driven planning. Furthermore, the integration of AI and machine learning (ML) into academic curricula equips students with computational thinking, multidisciplinary perspectives, and lifelong learning skills, thereby enhancing employability and preparing them for the demands of the Fourth Industrial Revolution. Despite challenges such as infrastructure deficits, policy gaps, and ethical concerns, AI offers significant opportunities for Nigerian tertiary education to align with global technological advancements. The chapter concludes that strategic integration of AI can enrich educational quality, strengthen research productivity, and advance community impact in Nigerian universities, positioning them as competitive actors in the global knowledge economy.

Introduction

Academic institutions have been increasingly implementing artificial intelligence (AI) in various aspects of their operations. The benefits of AI technology in tertiary institutions are numerous and

impactful. Firstly, AI has improved the efficiency and accuracy of administrative tasks such as student enrollment, scheduling, and grading. This has not only reduced the workload of faculty and staff, but also freed up more time for them to engage in other important activities. In terms of teaching and learning, AI has also proven to be a valuable tool. With the help of AI, course materials can be tailored to individual students' needs and learning styles, leading to a more personalized and effective learning experience. AI-powered chatbots have also become popular in providing students with 24/7 assistance and support, making education more accessible and convenient. (Schwab, 2016; Russell & Norvig, 2010; World Economic Forum, 2018; Ogunode, 2025; Ukeh & Anih, 2024).

The benefits of AI in tertiary institutions are clear. From streamlining administrative processes to enhancing teaching and learning to advancing research, AI has proven to be a valuable asset in the academic world. As technology continues to advance, it is expected that the role of AI in tertiary institutions will only continue to grow and evolve. AI is a branch of Computer Science that entails the study and creation of systems that can learn new concepts and tasks, reason and draw useful conclusions, understand a natural language or perceive and comprehend a visual scene using human type of intelligence (Shukla & Jaiswal, 2013). Moreover, AI contributes to research efficiency by enabling advanced data analysis and facilitating collaborations. These developments mark AI as a core product of the Fourth Industrial Revolution, enabling machines to perform tasks such as visual perception, speech recognition, and decision-making (Shukla & Jaiswal, 2013; Eleyyan, 2021). AI is also an example of Education Revolution 4.0 products which are formed by computer and capable machines like robots to perform complex tasks such as visual perception, speech recognition, and decision-making (Eleyyan, 2021). AI promotes personalised productive learning behaviour, such as self-regulation, self-monitoring, and self-explanation as it provides learning activities at the learners' pace and with the most appropriate content, timely guidance, feedback and explanations (Fernandez, Fernandez, & Aburto, 2019). Intelligent Tutoring Systems provide personalised learning to learners, automatic correction of certain kinds of schoolwork, which enables lecturers to have time for other tasks, help lecturers adjust their courses to some extent, provide ongoing feedback on students' assignment. The government of Nigeria has taken steps to promote partnerships and stakeholder engagement towards the advancement of AI in the country, this is obvious in the formation of a National Agency for Research in Robotics and Artificial Intelligence (NARRAI) in 2018.

This chapter is structured under the following headings:

- Clarification of concepts
- Tertiary education
- Artificial intelligence
- The imperative of AI integration in tertiary education

- Applications in teaching, research, and community service
- Advantages of integrating AI and machine learning into the curriculum

Clarification of concepts

Tertiary education

Tertiary education encompasses specialized learning pursued beyond high school, including undergraduate and graduate credentials such as certificates, diplomas, and academic degrees. This form of education, which is non-compulsory, is provided by institutions like colleges, polytechnics, and universities. Tertiary education can be delivered through various modalities, including in-person, virtual, or distance learning (Top-hat, 2023). Tertiary education is a structured and organized system designed to foster the holistic development of individuals and drive societal transformation through comprehensive teaching, research, and community service (Ogunode, Edinoh & Okolie, 2023). Tertiary education is an organized educational system that is consciously designed for manpower production, in-service training and national development. Tertiary education is an education that advances teaching, research and community services for national development. Tertiary education is an education industry that is meant for the production of manpower and national development via implementation of teaching, research and provision of community services (Ogunode, 2025).

Objectives of tertiary education in Nigeria include producing skilled graduates, advancing research, promoting scholarship, fostering unity, and supporting socio-economic development (FRN, 2013). Its success depends on adopting innovative teaching and learning strategies, including AI integration.

Also, to provide higher education opportunities via effective teaching, researching and provision community services; to develop produce students with specialized knowledge and skills for solving personal problem and national problem; to prepare student for national workforce and to contribute to societal and community development; to provide academic program of various disciplines; to provide quality instruction in field of studies and to conduct researches to generate new knowledge for national development and to solve complex problems (Ogunode, 2025). The goals of tertiary education in Nigeria include to providing accessible and affordable quality learning opportunities in both formal and informal settings to address the diverse needs and interests of all Nigerians. Tertiary education aims to offer high-quality career counseling and lifelong learning programs that equip students with the knowledge and skills necessary for self-reliance and success in the workforce. Additionally, it seeks to reduce skill shortages by producing skilled manpower that meets labor market demands, promote scholarship, entrepreneurship, and community service, foster national unity, and enhance both national and international

understanding and interaction (FRN, 2013). The realization of the tertiary education objectives depends on many factors such as the adoption of innovative teaching methods.

Artificial Intelligence

Artificial Intelligence (AI) has emerged as a transformative force across various sectors, offering innovative solutions to complex problems. In the realm of education, AI holds the potential to revolutionize traditional teaching methods and streamline research processes. Artificial Intelligence refers to the development of computer systems capable of performing tasks that typically require human intelligence. This includes a range of technologies, including machine learning, natural language processing, and data analytics. AI systems leverage algorithms and data to simulate cognitive functions, enabling machines to analyze information, adapt to changing circumstances, and improve performance over time (Russell & Norvig, 2010). Ogunode and Ukozor (2023) defined Al as programmes designed with human-like intelligence and structured in the forms of computers, robots, or other machines to aid in the provision of any kind of service or tasks to improve the social economic and political development of the society. Artificial Intelligence is an application or program constructed to carry out tasks with human-like intelligence.

Frankenfield (2023) defined Artificial intelligence (AI) as the simulation of human intelligence by software-coded heuristics. Artificial Intelligence is a branch of science producing and studying machines aimed at the stimulation of human intelligence processes. Artificial intellect (AI) is an innovative technical framework that encompasses the creation of computer systems with the ability to execute activities that usually need human intellect (Aina, Gbenga-Epebinu, Olofinbiyi, Ogidan, and Ayedun, 2023). These activities involve problem-solving, acquiring knowledge, comprehending language, and seeing visual information. AI has become increasingly prominent in recent years, bringing about a revolutionary transformation in the methods by which jobs are completed in numerous businesses. Within the realm of education, artificial intelligence (AI) offers a multitude of possibilities to augment the learning process. Intelligent systems provide the ability to adjust to the specific requirements of each learner, deliver tailored learning experiences, and provide immediate feedback (Aina et al., 2023).

Artificial intelligence (AI), according to Copeland (2023) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from experience. AI applications in education encompass adaptive learning platforms, intelligent tutoring systems, and virtual simulations. Through the use of artificial intelligence, educators have the ability to construct dynamic and interactive learning environments that accommodate the various learning styles and capabilities of students. The use of AI tools and technology in secondary school science classrooms has the potential to fundamentally transform the methods of

teaching and learning, hence enhancing accessibility, engagement, and effectiveness of education (Okunade 2024).

AI applications in education include intelligent tutoring systems, adaptive platforms, automated grading, plagiarism detection, and predictive analytics (VanLehn, 2011; Romero & Ventura, 2010; Sallam & Hossain, 2018). These tools personalize learning, improve assessment fairness, and enhance academic integrity.

The Imperative of AI Integration in Tertiary Education

The Fourth Industrial Revolution underscores the urgency of equipping students with AI-related competencies (Schwab, 2016). AI integration in higher education aligns curricula with workforce demands, ensuring graduates' employability in rapidly changing labor markets (World Economic Forum, 2018). Nigerian universities, particularly in science and technology, must strategically adopt AI to prepare students for global competitiveness (Olatunde-Aiyedun, 2024).

As we traverse an era dominated by the Fourth Industrial Revolution, marked by the convergence of technologies, educators are increasingly acknowledging the necessity of readying students for the challenges posed by an AI-driven future (Schwab, 2016). In this context, AI skills are rapidly becoming indispensable for a workforce navigating a perpetually evolving technological landscape. Schwab's insights (2016) emphasize the urgency of preparing students for the profound shifts brought about by the Fourth Industrial Revolution, underscoring the importance of incorporating AI skills into educational frameworks.

The World Economic Forum (2018) further supports this perspective, highlighting the emergence of the integration of AI into higher education curricula as a strategic response. In the face of an accelerating digital age, where technological advancements shape the workforce's requirements, the infusion of AI into higher education is seen as a proactive measure to arm students with the essential skills for success. The World Economic Forum's report (2018) emphasizes the strategic significance of aligning educational curricula with the demands of the contemporary job market, where proficiency in AI is increasingly valued.

In the specific context of Nigerian universities and the integration of AI into science education curricula, Schwab (2016) and the World Economic Forum (2018) provide valuable insights. These sources underscore the global recognition of the imperative to adapt educational systems to the demands of the Fourth Industrial Revolution, positioning AI as a cornerstone for success in the digital era. By integrating AI into science education, Nigerian universities can strategically equip their students with the skills needed to thrive in an AI-driven future, aligning with the broader global movement towards preparing individuals for the challenges and opportunities presented by rapid technological advancements (Olatunde-Aiyedun 2024).

Teaching

The use of artificial intelligence (AI) in teaching has been steadily increasing in tertiary institutions over the years. It has been proven to support teaching in numerous ways, such as improving student engagement and personalized learning. AI can also assist in grading and assessment, allowing teachers to have more time for other tasks. Furthermore, AI can help identify areas where students may need additional support and provide them with targeted resources. Overall, the integration of AI in teaching has shown great potential in enhancing the learning experience in tertiary institutions.

Numerous AI-based tools have been developed to cater to the unique needs of teaching and research in the academic setting. These tools harness advanced algorithms and data processing capabilities to streamline tasks, offer personalized learning experiences, and provide valuable insights for research endeavors. Some of these AI-based tools include Intelligent Tutoring Systems (ITS): Intelligent Tutoring Systems utilize AI algorithms to adapt to individual learning needs. These systems provide personalized feedback and guidance to students, aiding in their academic progress. For lecturers, ITS can be a valuable tool for tailoring teaching materials based on individual student requirements (VanLehn, in Ukeh, & Anih, 2024).

It involves leveraging AI tools to enhance teaching methodologies, streamline research processes, and ultimately improve the overall quality of education (Anderson & Dron, in Ukeh, & Anih, 2024). The utilization of these AI-based tools is paramount, because, it enhances Personalization, take for instance, AI-based tools, such as Intelligent Tutoring Systems (ITS), enable personalized learning experiences by adapting to individual student needs. This personalized approach enhances student engagement and comprehension. It also enables efficiency in Grading and Assessment, like, Automated grading systems, powered by AI, streamline the assessment process for lecturers. This not only saves time but also ensures consistency and objectivity in evaluations.

Plagiarism Detection Software is an AI-powered plagiarism detection tools crucial in maintaining academic integrity. These tools employ advanced algorithms to compare submitted work with vast databases, identifying instances of plagiarism and ensuring the authenticity of research outputs (Sallam & Hossain, 2018, Anih 2019; Ukeh, & Anih, 2024). Automated Grading Systems: Automated grading systems, driven by AI, can efficiently assess assignments, exams, and coursework. These systems not only save time for lecturers but also provide consistent and unbiased evaluations, fostering fairness in the assessment process (Zafar, Rehman & Amin, 2018; Ukeh, & Anih, 2024). Other AI-based tools still include, predictive analytics tools, this tool utilizes AI algorithms to analyze historical data and predict student performance trends. Lecturers can leverage these insights to identify at-risk students early on, enabling targeted interventions to support their academic success (Romero & Ventura, 2010;Ukeh, & Anih, 2024).

Research

Artificial intelligence (AI) has been playing a crucial role in supporting research in tertiary institutions. With its advanced capabilities, AI has been able to assist researchers in various stages

of their work, from data analysis to hypothesis generation. By leveraging machine learning and natural language processing techniques, AI has been able to sift through massive amounts of data and identify patterns, making it easier for researchers to draw meaningful conclusions. AI has also been aiding in literature review processes by providing automated summaries of academic papers. By analyzing the abstracts, keywords, and citations of existing research, AI can generate an abstract that provides a concise overview of the background, methods, and results of a particular topic. This not only saves researchers time and effort, but also ensures that they have a comprehensive understanding of the existing literature in their field.

AI has been able to facilitate collaboration and knowledge sharing among researchers. By analyzing research papers and identifying common themes, AI can connect researchers working on similar topics and facilitate the exchange of ideas and resources. This has the potential to enhance the quality of research and lead to new and innovative discoveries. AI has been a valuable tool in supporting research in tertiary institutions. Its ability to analyze data, generate summaries, and facilitate collaboration has greatly enhanced the research process, ultimately leading to the advancement of knowledge in various fields. As AI continues to evolve and improve, it is expected to play an even bigger role in academia, revolutionizing the way research is conducted.

More also in research for instance, it provides Advanced Data Analytics, Predictive analytics tools utilize AI algorithms to analyze historical data, providing insights into student performance trends. Lecturers can proactively identify students at risk and tailor interventions accordingly. AI- based tools as well provides Innovative Research Insights, AI facilitates more efficient literature reviews and research topic selection. Recommendation systems help researchers stay abreast of emerging trends, fostering innovative and impactful research (Siemens, 2013).

AI-based tools in teaching and research holds immense importance for advancing education and knowledge creation. Not only that, In education, numerous global systems have embraced digital technology-based approaches such as e-learning, distance education, e-assessment, artificial intelligence, cloud computing, and gamification for instructional delivery and assessment (Ukeh & Nwankwo, 2023; Anih & Ukeh, 2023. Research Topic Recommendation Systems, this AI-based recommendation system analyzes academic literature, citation patterns, and emerging trends to suggest relevant research topics. Lecturers can use these tools to stay abreast of current developments and discover novel avenues for their research endeavors (Ren, Shen & Zhang, 2012).

AI software and web browsers can be used to predict citation impact, automate the extraction of references from PDF articles, organise and share research questions in research. Thus, AI frees the researcher time that would have been used for sorting and arranging of reference materials, examples of such software and web browser are Mendeley, Scopus, and EndNote. AI integrated Grammarly Premium to automate proofreading identify and correct errors in research writing while also preventing plagiarism; this will enable the researcher to focus on the content being

written rather than the grammatical or spelling errors. Education develops mind and expands knowledge bases and learning process involves a person carrying out a particular action within a specific situation, and then recognising the effect of that action (Turesky & Gallagher, 2011).

Community Service

Artificial Intelligence (AI) has been widely used in the academic community to support community service activities in tertiary institutions. Through the use of AI tools, academic institutions are able to efficiently identify and address the needs of their surrounding communities. This has greatly improved the overall impact and effectiveness of community service efforts. AI supports community service in academic institutions is through the automated analysis of community needs. By inputting data on the demographics and specific needs of the community, AI algorithms are able to identify and prioritize the most pressing issues. This allows academic institutions to focus their resources and efforts on addressing these needs, resulting in more impactful community service projects. AI is also used to optimize resource allocation for community service initiatives. Through machine learning algorithms, academic institutions can analyze previous data on community service projects and identify patterns in resource allocation and utilization. This allows them to efficiently allocate resources in future projects, ensuring that the needs of the community are met in the most effective and efficient way possible.

AI plays a crucial role in data management and analysis for community service projects. By leveraging natural language processing and data mining techniques, AI tools are able to extract insights and trends from large amounts of data collected from community service activities. This information is then used to inform future projects and improve the overall impact of community service efforts. AI has revolutionized the way academic institutions approach community service. By utilizing AI tools, universities are able to better understand and address the needs of the community, resulting in more effective and impactful community service initiatives.

Advantages of Integrating AI and Machine Learning into the Academic Curriculum

Oluwagbenro, (2024) noted that AI can aid the following in the tertiary institutions;

Augmented Student Engagement

By incorporating AI and ML into the educational framework of Nigerian state universities, educators can enhance student engagement significantly. Utilizing methods such as interactive simulations, personalized learning paths, and adaptive assessment tools creates an immersive and captivating learning environment. These approaches deepen students' understanding of complex subjects and enrich their overall educational experience.

Enhancement of Analytical and Problem-Solving Proficiency

The integration of AI and ML-based projects and coursework enable students to refine their analytical and problem-solving skills to an advanced level. Through hands-on exposure to data-

driven decision-making, algorithmic reasoning, and the development of innovative solutions, students acquire the capabilities needed to tackle real-world challenges in their future careers electively.

Future Career Preparedness

As AI and ML technologies increasingly permeate diverse industries, it's vital to equip students with relevant skills for the evolving job market. By integrating these technologies into the curriculum, Nigerian state universities can ensure graduates are well-prepared to excel in dynamic, tech-driven career landscapes, enhancing their employability and competitiveness in emerging sectors.

Preparing Students for Future Employment Opportunities

Integrating Artificial Intelligence (AI) and Machine Learning (ML) into the undergraduate curriculum within Nigerian state universities stands as a pivotal step towards enriching students' educational experiences and arming them with the requisite skills for upcoming employment prospects. By immersing students in the forefront of these technological advancements, universities can ensure their graduates possess the competencies needed to navigate the evolving demands of employers and contribute significantly to the advancement and innovation across diverse industries.

Promoting Critical Thinking and Problem-Solving Skills for the Future

1. Cultivating Computational

Thinking By integrating AI and ML into the curriculum, Nigerian state universities have the opportunity to foster computational thinking skills among students. Computa-tional thinking involves dissecting complex problems, recognizing patterns, and devising algorithms to devise solutions. These skills are crucial for navigating the technology-driven future.

2. Encouraging Multidisciplinary Perspectives

The incorporation of AI and ML can stimulate a multidisci-plinary approach, prompting students to explore the convergence of technology with various fields such as business, healthcare, and social sciences. This interplay of ideas fosters critical thinking, fostering innovative solutions, and a deeper comprehension of real-world challenges.

3. Emphasizing Lifelong Learning

As AI and ML technologies advance, the curriculum should underscore the significance of lifelong learning. By instilling a growth mindset and providing students with the adaptability to embrace evolving technological landscapes, Nigerian state universities can empower their graduates to thrive in the future job market. Moreover, this equips them to contribute meaning- fully to the long-term economic and social development of the nation.

Summary

AI has revolutionized research in tertiary institutions. Through advanced algorithms and data analysis, AI can quickly sift through vast amounts of information and identify patterns and trends that would have been difficult for humans to spot. This has greatly accelerated the pace of research and opened up new possibilities for scientific breakthroughs. The incorporation of AI in tertiary institutions has also led to significant cost savings. By automating certain tasks, institutions can save on labor costs and allocate resources more efficiently. This can ultimately result in lower tuition fees for students and a more affordable education.

AI is reshaping tertiary education by enhancing teaching, streamlining research, and strengthening community service. Its integration equips students with essential skills for the Fourth Industrial Revolution, improves institutional efficiency, and positions Nigerian universities for global competitiveness. Strategic investment in AI infrastructure, training, and ethical governance will ensure that Nigerian higher education maximizes AI's transformative potential.

Review Questions

1. What is tertiary education?
2. Define Artificial Intelligence.
3. Outline three imperatives of AI integration in tertiary education with respect to: teaching, research, and community service.
4. Discuss three advantages of integrating AI and machine learning into the academic curriculum.

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