Challenges And Prospects in The Efficacy of Technologies in The Transformation of Education for Tertiary Institutions in Nigeria

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Abstract

Around the world, the importance of integration of emerging technologies such as artificial intelligence, robotics, and blockchain cannot be underscored, as these technologies are presumed to play a pivotal role not only in revolutionizing traditional educational paradigms but also in enhancing various aspects of the academic experience, and thereby contributing to the overall growth and development of tertiary institutions. It is on this premise that this study explored the efficacy of emerging technologies, delving into considering the transformation of education for tertiary institutions in Nigeria. First, the study provides a brief literature review on emerging educational technologies such as artificial intelligence, robotics, and blockchain. Next, it presented Technology Acceptance model (TAM) as theoretical contribution. Thereafter, it demonstrated that fear of job disruption, inadequate technology infrastructures, insufficient allocation of funds, and shortage of trained technology professionals, privacy and security concerns, and resistance to change were identified as some of the challenges of most of the tertiary institutions as a result of the use of different technologies. Furthermore, the prospects for transformation of education for tertiary institutions includes: personalized learning experiences, enhanced teaching, transparency and accountability, collaborative research opportunities, and administrative efficiency and resource management. It was concluded that appropriate utilization of emerging technologies such as artificial intelligence, robotics, and blockchain would offer exciting opportunities for innovative learning experiences in the institutions. It was suggested that stakeholders in education sectors should collaborate with non-governmental organizations and technology developers

through continued research and development to ensure the transformation of education propelled by innovative technological advancements.

Key Words: *Technologies, Education Transformation, and Tertiary Institutions*

Introduction

Across the globe, tertiary institutions play a vital role in societal development, progress, and transformation of education. These institutions serve as hubs for knowledge creation, dissemination, and innovation, fostering intellectual growth and critical thinking among students. Additionally, the institutions equip individuals with specialized skills and expertise necessary for various professions, driving economic growth and competitiveness. Aside from these, it offers diverse academic programmes and research opportunities that would empower students to become leaders and change agents in their respective fields (Orakwue & Emere, 2021). Furthermore, tertiary institutions serve as engines of research and innovation, generating new knowledge and solutions to complex societal challenges through academic research and collaboration with organizations. Hence, one of the primary benefits of tertiary institutions around the world for their contribution to human capital development cannot be overstated (Arnhold & Bassett, 2021).

In Nigeria, tertiary institutions serve as engines of research and innovation, generating new knowledge and finding solutions to complex societal challenges through technological advancements, scientific discoveries, and entrepreneurial initiatives. According to Ogunode and Odo (2023), tertiary institutions serve as platforms for interdisciplinary research and development, facilitating partnerships between academia, government, and the private sector to tackle pressing issues and drive inclusive growth. This symbolise that tertiary education enhances individuals' employability and job prospects, empowering them to pursue meaningful careers and contribute positively to society. Considering different views by these scholars concerning tertiary institutions, one can say that tertiary institutions are indispensable pillars of societal advancement, driving innovation, fostering human capital development, and promoting inclusive growth in Nigeria and beyond.

According to the National Policy of Education (2014), the goals of tertiary institutions among others include to contribute to national development through high level manpower training and to develop the intellectual capacity of individuals to understand and appreciate their local and

external environment. These goals are meant to be achieved through the integration of different emerging technologies such as artificial intelligence, robotics, and blockchain for the transformation of education. Aside from, leveraging on these technologies are presumed to play a pivotal role not only in revolutionizing traditional educational paradigms but also in enhancing various aspects of the academic experience, and thereby contributing to the overall growth and development of tertiary institutions.

In 2019, it was evident as the United Nations Education Scientific and Cultural Organization (UNESCO) indicated that emerging technology such as artificial intelligence (AI) has permeated various sectors of the society, more particularly, the education sector. Other areas or ways in which AI has been implemented in education include learning and administration, which has been precipitated by changes in the general environment. However, observations by the general public in some quarters emerged that most of the tertiary institutions in Nigeria, quite frankly, are grappled with the ever-growing challenges that could hindered the efficacy of technology in transforming education within Nigerian tertiary institutions. Topmost on the list of challenges faced by the institutions include inadequate funding, poor infrastructure, poorly remunerated academics, outdated curriculum, unreliable electricity and internet connectivity, bureaucracy, insecurity, among others (Famade, Omiyale & Adebola, 2015; Daminabo, 2020; Vincent et al., 2022). In addition, AI, along with its promises also raises ethical, social, and economic considerations, including issues related to privacy, bias, job displacement, and socioeconomic inequality (Benefo et al., 2022).

Considering this, the education sector across the globe is one of the largest growing sectors with significant social, technical, and economic challenges. Tertiary institution is a multifaceted organisation with deep-rooted incumbents and important cultural norms and traditions. However, the integration of digital technology in education has become a permanent fixture (Meyliana et al., 2020; Turnbull et al., 2021). On this premise, providing a comprehensive overview of the challenges and prospects associated with the efficacy of technologies in transforming education for Nigerian tertiary institutions is eminent.

The information provided in this study will be of benefit to various stakeholders in the education sector. It will contribute to the growing development of knowledge, theory, and discussions on emerging technologies in Tertiary Institutions. Also, it will benefit scholars, professionals, and policy makers, such as administrators, management and leadership of

educational institutions and the education sector, by fostering evidence-based decision-making and management and leadership practices in the sector. The discussion in this context will also augment other studies and inform government policy and actions aimed at fostering meaningful use of emerging technologies, particularly, AI, robotics, and blockcain in the education sector, with an understanding of innovative learning experiences in the institutions.

Theoretical Review

The study was built on Rogers and Roger (1995) who developed Technology Acceptance model (TAM) and proposed that the adoption of technological innovation in organisation practices usually alludes to the company's success in the future. Subsequently, many authors suggested multiple theories like Technology Acceptance model (TAM), Technology Assimilation theory (TAT), Perceived-Readiness model (PRM) on technological adoption based on the objectivity for the same (Armstrong & Sambamurthy, 1999; Molla & Licker, 2005; Venkatesh & Davis, 2000). However, in the present study authors intended to provide a comprehensive overview of the challenges and prospects associated with the efficacy of emerging technologies in transforming education within Nigerian tertiary institutions. The TOE framework comprehensively encompasses the different contexts of technology like user benefits, pre-requisites of resources and infrastructure, operational complexities, and safety as few of the factors likely to influence the adoption.

In addition to this, TOE model encapsulates the brief idea of the context like organizational readiness termed as top management support and inclination for technology, size and structure of company, technological know-how by the company experts, its relevance for adoption, and sufficient availability of infrastructure (Dutta et al., 2020; Gangwar et al., 2014; Wang et al., 2010). The role of environment in the context of adoption is referred as the organizations' competency to face day-to-day operational challenges, strategies to cope up with industry dynamics, legal, governmental, and regulatory intricacies (Lippert & Govindarajulu, 2006). Tornatzky and Fleischer (1990), while processing on technological innovation, focused on Technology-Organization Environment (TOE) as an initial readiness of any organization to adopt the technology-based business practices. The TOE framework proposes the possibility of technological adoption when it receives support from organization, environment, and technology (Gangwar et al., 2014).

Past studies which adopted the TOE framework in their investigation were mainly conducted in the field of cloud computing adoption, or to study the challenges faced by organizations during adoption of blockchain technology (Dutta et al., 2020; Ganguly, 2022), but there is a dearth of such research in the education sector, especially in the emerging technological adoption. The Technology Acceptance Model, which has been one of the most influential models of technology acceptance, is relevant to this study because it focuses on two main factors that influence a person's intention to use emerging technologies, perceived ease of use and perceived prospects in relation to tertiary institutions.

Concept of Emerging Technologies

Emerging technologies refer to innovative advancements that are currently in the early stages of development or adoption and have the potential to significantly impact various aspects of society, economy, and daily life. These technologies often represent cutting-edge research and development efforts in fields such as information technology, biotechnology, nano-technology, robotics, and artificial intelligence. For instance, examples of emerging technologies include artificial intelligence (AI), which encompasses machine learning composed of natural language processing and capable of performing tasks that typically require human intelligence, blockchain, which is a decentralized digital ledger system; and robotics, which consists of machines capable of performing human-robot coexistence in the modern world, and gene editing technologies, which enable precise manipulation of genetic material (Dutta et al., 2020). In this context, tree forms of emerging Technologies such as Artificial intelligence, Robotics, and Blockcain are discussed.

Artificial Intelligence

Over the years, technologies have continued to evolve across all sectors, with no exception to education system, leading to the development of artificial intelligence. According to Ogunode, Okolie and Chinedu (2023), Artificial intelligence (AI) is the ability of machines to adapt to new situations, deal with emerging situations, solve problems, answer questions, device plans, and perform various other functions that require some level of intelligence typically evident in human beings. In another definition, Whitby defined artificial intelligence as the study of intelligence behaviour in human beings, animals, and machines and endeavouring to engineer such behaviour into an artifact, such as computers and computer-related technologies (Chen, Chen & Lin, 2020). According Demir and Güraksin (2021), artificial Intelligence (AI) is a transformative concept in computer science that involves the development of intelligent systems capable of performing tasks

that typically require human intelligence. At its core, AI seeks to mimic human cognitive functions, such as learning, problem-solving, perception, and decision-making, using algorithms and computational techniques.

In addition, Chassignol et al. (2018) provides a two-faceted definition and description of AI. They define AI as a field and a theory. As a field of study, they define AI as a study area in computer science whose pursuits are aimed at solving different cognitive problems commonly associated with the human intelligence, such as learning, problem solving, and pattern recognition, and subsequently adapting. Similarly, Chassignol et al. (2018) defined AI as a theoretical framework guiding the development and use of computer systems with the capabilities of human beings, more particularly, intelligence and the ability to perform tasks that require human intelligence, including visual perception, speech recognition, decision-making, and translation between languages. In the view of Greenwald, Leitner and Wang (2021), the concept of AI encompasses various subfields, including machine learning, natural language processing, computer vision, and robotics. As machine learning, in particular, is a crucial component of AI, enabling systems to learn from data and improve their performance over time without explicit programming.

Drawing from these definitions, it is evident that artificial intelligence is the culmination of computers, computer-related technologies, machines, and information communication technology innovations and developments, giving computers the ability to perform near or human-like functions. As AI algorithms through the analysis of vast amounts of data can uncover patterns, make predictions, and derive insights to support decision-making in diverse domains, ranging from healthcare and finance to education and transportation. In this connection, the development and application of AI hold immense potential to revolutionize numerous aspects of society, driving innovation, efficiency, and progress. In healthcare, AI-powered systems can assist in disease diagnosis, drug discovery, and personalized treatment recommendations, leading to improved patient outcomes and healthcare delivery (Secinaro et al., 2021). In the business sector, AI technologies facilitate automation, predictive analytics, and customer relationship management, enabling organizations to optimize processes, enhance productivity, and gain competitive advantages (Akerkar, 2019).

In tertiary institutions, Artificial Intelligence (AI) holds immense usefulness for offering various opportunities to enhance teaching, learning, research, and administrative processes. One

significant benefit of AI in tertiary education is its potential to personalize learning experiences. For instance, AI-powered adaptive learning platforms can be used for analysing students' learning patterns, preferences, and performance data to tailor educational content and activities to their individual needs and pace, thereby improving engagement and academic outcomes (Daminabo, 2020). Additionally, AI facilitates the automation of administrative tasks, such as student enrollment, grading, and scheduling, freeing up faculty and staff to focus on more strategic initiatives and student support services. Based on this, Ilkka (2018) averred tat AI has the potential to transform education by personalizing learning experiences, automating administrative tasks, and facilitating adaptive tutoring systems tailored to individual student needs. Therefore, understanding of AI's capabilities, limitations, and implications is crucial to harness its benefits while mitigating potential risks and challenges as society navigates the increasingly AI-driven future.

Robotics

The concept of robotics has been explored and discussed by various scholars from diverse perspectives. For instance, Zhang et al. (2022) viewed robotics as the interdisciplinary field concerned with the design, development, and application of robots-autonomous or semi-autonomous technology or machines capable of performing tasks in the physical world. These robotics technologies applications include hardware design, sensor integration, motion planning, and artificial intelligence algorithms that are used for creating robots that can assist humans in various tasks, such as manufacturing, education, healthcare, exploration, and household chores. According to Scaradozzi, Screpanti and Cesaretti (2019), the concept of robotics is an interconnected and diverse field that includes technological, philosophical, and societal aspects. It provides a framework for understanding the opportunities and difficulties of human-robot collaboration in the modern world.

Bredeche, Haasdijk and Prieto (2018) described robotics as a technological instrument that can be utilized to provide a distinctive educational approach by fusing STEM subjects with real-world application. Robotics education has the potential to give students the tools they need to thrive in the twenty-first-century economy, as institution places an increasing emphasis on workforce development and technological innovation. In the education system for instance, Zhang et al. (2022) asserted that robotics-autonomous technology are specifically developed and used for teaching and learning. It come in a variety of forms, shapes, and sizes, ranging from small robotic

devices that students can program themselves to larger machines that are intended to engage in more social interactions with students. Aside from this, Hietanen et al. (2020) indicated that robotics is an excellent tool for educating students for the demands of the workforce of the twenty-first century because it provides a multidisciplinary approach to learning that incorporates elements of science, technology, engineering, and mathematics (STEM). Therefore, the use of robotics in educational institutions has attracted a lot of attention recently, not only in Nigeria but throughout the world.

Witwicki et al. (2017) identified perception, decision-making, and enhanced actuation as the three core elements of robotics, in which perception as to with the process through which robots collect information about their surroundings through ultrasonic sensors. In decision-making, AI algorithms are used to process data and create suitable results, while enhanced actuation is the process by which the robot moves or is manipulated physically in response to decisions made. From this perspective, robotics is seen as a means to augment human capabilities, improve efficiency, and address societal challenges by automating repetitive or dangerous tasks and extending human reach into environments inaccessible or hazardous to humans alone. Furthermore, Angel-Fernandez and Vincze (2018) identified six popular types of robots that are utilized in numerous industries to increase productivity, speed up procedures, increase safety, and improve experiences. These consist of articulated robots, humanoids, cobots, autonomous mobile robots (AMRs), automated guided vehicles (AGVs), and hybrids.

In today's technologically advanced society, Reesink et al. (2021) postulated that robotics in tertiary institutions encompasses theoretical knowledge, hands-on experimentation, and practical applications across disciplines such as engineering, computer science, mathematics, and physics. It also involves the study of robot design principles, mechanisms, sensors, actuators, control systems, and programming languages. Moreover, Lane (2018) argued that robotics in education often includes laboratory work, projects, and research initiatives aimed at exploring the capabilities and potential applications of robots in diverse real-world scenarios. Equally, robotics technologies in several commercial, military, and organizations are indispensable and widely utilized in environmental monitoring, manufacturing, industry, and medical science research and development. In this regard, robotics in tertiary institutions serves as a platform for students to gain theoretical knowledge, practical skills, and experiential learning experiences that prepare

them for careers in fields such as robotics engineering, automation, artificial intelligence, and mechatronics (Pramanik et al., 2020).

Blockchain

The concept blockcain has generated a lot of discussions across the world. This is as a result of the recent global changes and innovations in the educator sectors. According to Fedorova and Skobleva (2020), blockchain technology is advanced database mechanism that is linked together in a chain and allows transparent information sharing within a business network. In the view of Atienza-Mendez and Bayyou (2019), blockchain technology as a decentralized and distributed ledger system that enables secure and transparent record-keeping of transactions across a network of computers. At its core, a blockchain consists of a chain of blocks, each containing a list of transactions. These blocks are linked together in a chronological and immutable manner, forming a continuous and tamper-proof record of all transactions conducted on the network. It was further indicated blockchain technology is characterised by a decentralized nature, which means that the ledger is maintained by a network of nodes rather than a central authority. This implies that decentralization ensures that no single entity has control over the entire network, enhancing security, transparency, and trust in the system.

Furthermore, Ibor, Ofem and Obidinnu (2018) asserted that blockchain technology no doubt is gaining traction in tertiary institutions in Nigeria, offering innovative solutions to enhance transparency, accountability, and security in various domains. It can be utilized to securely store and share academic credentials, certifications, and transcripts, ensuring the integrity and authenticity of educational records. Moreover, blockchain-based platforms facilitate peer-to-peer transactions, enabling seamless payments for tuition fees, scholarships, and student allowances. Additionally, it has the potential to revolutionize research collaboration and intellectual property management by providing transparent and immutable records of research outputs, patents, and copyrights (Kosasi et al., 2022).

Blockchain was initially deployed to manage the business of cryptocurrency way back in early 2000, it is now a technology with multiple benefits for all business sectors (Arndt & Guercio, 2020). The biggest advantage of Blockchain technology, other than the decentralization of data, is that it is considered as one of the most trusted platforms for building secure data network and it cost effective as it removes intermediaries in distributed applications. It also offers the advantage of creating secure data that cannot be tweaked by anyone, once the data is entered in the public

ledger (Bhaskar et al., 2021). Thus, building a structure for blockchain technology with strong cybersecure capabilities has applications for every business sector and is highly in demand. More recently, higher education has become closely aligned with private sector commerce as a recipient and producer of commercial innovation (DuPont, 2021). However, the adoption of Blockchain technology in the education sector is not only in nascent stage but also making very slow strides (Kosmarski, 2020; Loukil et al., 2021; Mohammad & Vargas, 2022).

The education sector as one of the largest emerging sectors globally and adoption of Blockchain in education sector offers several benefits like disbursement of certificates, validation, and sharing of data in shared network (Bhaskar et al., 2021), and along with this, it will enable the employers in design the smooth processing of administrative activities (Ellis, 2016). Gatteschi et al. (2020) identified the role of Blockchain as a tool to validate the authenticity and accreditation of the shared data, increasing the trust among the users. Further, Chen (2018) added the benefits of Blockchain technology in education sector by pointing out its potential usage in tracking the students' academic and professional journey.

Challenges of Emerging Technologies Tertiary Institutions in Nigeria

Emerging technologies such as artificial intelligence (AI), robotics, and blockchain are gradually making their way into tertiary institutions around the world, offering transformative opportunities to revolutionize teaching, learning, research, and administrative processes. However, these technologies present some pertinent challenges that hinder the transformation of education for tertiary institutions in Nigeria. These include: Fear of job disruption, inadequate technology infrastructures, insufficient allocation of funds, and shortage of trained technology professionals, privacy and security concerns, and resistance to change.

Fear of Job Disruption

In Nigeria tertiary institutions, one of the biggest challenges of with the emerging technologies such as artificial intelligence (AI), robotics, and blockchain is that academics are concerned about the possibility of losing jobs to digital machines and the extent to which it can significantly replace humans. Aside from this, DuPont (2021) affirmed that it has remained a constant debate that is buzzing in the tech world and among ordinary people as there are cases of elimination jobs characterized by routine tasks. Furthermore, Licardo, Domjan and Orehovački (2024) postulated that emerging technologies pose threat to tertiary institutions, triggering a fear

of job disruption among educators and administrators. The fear stems from the possibility of automation replacing certain tasks, such as grading, traditional administrative duties, and even some teaching functions, leading to potential job redundancies, depression, or the need for reskilling. Based on this, Salau *et al*. (2022) stated that the phenomenon is accompanied by creation of new job roles which could in turns require new skills and knowledge, which may considerably require a time commitment for learning and training. Hence, workforces of every organization are required to take proactive measures of up skilling and reskilling to fit into the new-age roles.

Inadequate Technology Infrastructures

Another matter of primary challenge facing the efficacy of technologies in Nigerian tertiary institutions is the inadequacy of infrastructure. A research conducted by Muharina and Kelana (2017) found that many tertiary institutions lack essential resources such as reliable internet connectivity, adequate power supply, and modern computer labs, consequently have negative impact on the institutions. Furthermore, Yang, Henthorne and George (2020) stated that out-dated infrastructure hampers the seamless integration of technology into the teaching and learning process, thereby limiting the potential benefits for students and educators alike. Several factors that appears have contributed to inadequate *infrastructure in institutions* include the *lack of*, or shortages, of funds, *insufficient* provision of developmental personnel as well as negligence of repair and maintenance of the existing digital tools. In this case, this situation makes it difficult for lecturers who are educators, students who are regarded as the client, and other internet users to make use of the online tools for pedagogical and administrative purposes to achieve the desired quality education. Therefore, without proper infrastructure, implementing and sustaining technological initiatives becomes exceedingly difficult.

Insufficient Allocation of Funds

Another significant challenge is the insufficient allocation of funds towards technological initiatives in tertiary institutions. This prevents institutions from investing in the critical hardware, software, and infrastructure upgrades required for successful technology integration. This has resulted in underequipped technology labs, inaccessibility to ICT and internet facilities, and inadequate training and development programs for staff members. Aside from this, it triggered increasing concerns as funds allocated to and technology resources provided to the education sector impacts negatively on the performance and sustainability of higher education in Nigeria. tis was affirmed by the United Nation Education Scientific and Cultural Organization (UNESCO)

(2021) which indicated that the education sector in recent years received less than 10% of the budget, despite the government's pledge to devote 26% of its yearly budget to this field. On the basis of this, it can be acknowledged that lack of funding in any given tertiary institutions, no doubt could affects their capacity to provide training and professional development opportunities for faculty members to effectively utilize educational technologies in their teaching practices.

Shortage of Trained Technology Professionals

The integration of emerging technologies in tertiary institutions require trained professionals that plays pertinent role in ensuring activities are well-coordinated towards gaols attainment. However, the shortage of professionals trained in related emerging technologies fields such as artificial intelligence (AI), robotics, and blockchain in tertiary institutions in Nigeria poses a challenge for institutions to deploy technologies into its systems. This was affirmed by Ogunode (2020) who highlighted that due to political meddling majority of tertiary institutions in Nigeria have inadequate technology integration because of a lack of technical specialists. Additionally, Mohammed, Ogunode and Yahaya (2021) revealed significant differences between tertiary institutions in Nigeria and those in the West, pointing to the lack of technological experts as one of the main impediments to sustainable development in higher education in Nigeria. Furthermore, Bubou and Job (2021) underscored the lack of computer skills, shortage of staff, and lack of commitment from both lecturers and students as barriers to integration at the tertiary institutions in South Africa. Based on this, Eze, Chinedu-Eze and Bello (2018) indicated that successful implementation and utilization of these technologies require workforce that are acquainted with the necessary expertise to manage and optimize the technologies.

Privacy and Security concerns

The integration of emerging technologies in tertiary institutions could involve the collection and analysis of vast amounts of sensitive data concerning the student, educators, and the institution at large. However, the primary challenge facing tertiary institutions in Nigerian for the adoption of technologies for effective administration lies in maintaining privacy and security of information. In this regard, Mihaljević et al. (2023) expressed that the adoption of technology could give rise to a multitude of apprehensions regarding security and data privacy. Also, the interconnectivity and complexity of technology may elevate a range of security concerns such as hacking, cyber-attacks, and unauthorized acquisition of sensitive data. Without proper implementation and management of the emerging technologies, the risk of unauthorized access to

the students' and staff's personal information which could be utilized for illegal purposes. Therefore, as security and privacy issues get more complicated in tertiary institutions, proactive steps such as adherence to privacy rules, and a powerful cybersecurity protocols are essential to be taken in order to protect individual and institutions information.

Resistance to change

Resistance to change implies the inability to adjust to novel situations or methods of operation. It can occur in interpersonal relationships, in organizations, or with individuals. In line with this, resistance to change among faculty members, administrators, and other stakeholders presents a significant barrier to the successful implementation of educational technologies. This is notably as some educators are perhaps hesitant to embrace technology in tertiary institutions due to a lack of familiarity and concerns about the efficacy of tech-based resources for teaching and management of education. According to Nakhoda and Tajik (2017), employee resistance to change frequently arises from a sense of being unprepared to embrace new procedures because they lack the knowledge, up-skilling opportunities, and end-user support systems necessary to help them navigate the early learning curve and rough patches in a new procedure, team structure, or software deployment. These factors may hinder the successful implementation of technological changes in the workplace. Therefore, overcoming resistance to change requires proactive efforts to foster a culture of innovation, provide adequate support and training, and demonstrate the tangible benefits of technology in enhancing teaching and learning experiences.

Prospects of Emerging Technologies in the Transformation of Education for Tertiary Institutions in Nigeria

Emerging technologies such as artificial intelligence (AI), robotics, and blockchain when properly used could present several stimulating prospects for transforming education in tertiary institutions in Nigeria through personalized learning experiences, enhanced teaching, transparency and accountability, collaborative research opportunities, and administrative efficiency and resource management.

Personalized Learning Experiences

One of the major prospects of emerging technologies AI-powered educational platforms can personalize learning experiences by analyzing students' learning patterns and preferences, thereby improving engagement and academic outcomes. Additionally, AI-driven chatbots and virtual assistants can provide instant support and guidance to students regarding course selection, academic resources, and administrative procedures, enhancing student satisfaction and retention

rates. This personalized approach could ensure that students get the right level of challenge and support, thereby making learning more effective and engaging.

Enhanced Teaching

Secondly, robotics presents opportunities to revolutionize hands-on learning experiences in tertiary institutions. By integrating robotics into curricula, institutions can offer students practical skills and knowledge in different fields such as education, engineering, computer science, and robotics research. Wit this, robotics labs and research centers could provide students with opportunities to design, build, and programme robots to foster critical thinking, problem-solving skills, and creativity. Moreover, robotics competitions and challenges would enable students to showcase their innovations, fostering a culture of entrepreneurship and innovation within the institution (Licardo et al., 2024).

Transparency and Accountability

The emerging technologies such as artificial intelligence (AI), robotics, and blockchain could offer prospects for enhancing transparency, accountability, and security in tertiary education. They can be used to securely store and share academic credentials, certifications, and transcripts by ensuring the integrity and authenticity of educational records. Additionally, these technologies as a platform can facilitate peer-to-peer transactions, enabling seamless payments for tuition fees, scholarships, and student allowances. Furthermore, the technologies have the potential to streamline research collaboration and intellectual property management by providing transparent and immutable records of research outputs, patents, and copyrights. Employing emerging technology in the realm of education could not only offer both merits, but enhance the institution's ability to systematically arrange and keep data across sundry departments in order to aid the retention and graduation rates of students (Razia & Awwad, 2022). On this note, it is necessary for institutions to navigate the complexities of data protection laws, implement robust cyber security measures, and establish clear policies for data access and usage to safeguard against potential breaches and unauthorized access (Zawacki-Richter etal, 2019). Hence, the need to have proper understanding of incorporating these technologies into the pre-existing educational systems is imminent.

Collaborative Research Opportunities

Employing emerging technologies in the realm of education can support interdisciplinary collaboration and research in tertiary institutions. AI, robotics, and blockchain can serve as

catalysts for collaboration among faculty and students from diverse disciplines, including education, engineering, computer science, social sciences, and other related sciences. It is believed that collaborative research projects can address complex societal challenges, such as education management robotics, healthcare, environmental monitoring, and technology applications for governance and transparency. Moreover, the interdisciplinary collaboration fosters innovation and knowledge exchange, preparing students for careers that require interdisciplinary skills and perspectives (Georgescu, Avasilcai & Peter (2021)

Administrative Efficiency and Resource Management

It is presumed that emerging technologies can improve efficient administrative operations and resource management which are crucial elements of institutional governance and sustainability, allowing institutions of higher learning to successfully carry out their stated goals of delivering high-quality instruction, advancing knowledge, and meeting the needs of their stakeholders and students. This was affirmed by Tambe, Cappelli and Yakubovich (2019) who indicated that analytics technologies driven by artificial intelligence (AI) have the capacity to examine vast amounts of data in order to maximize the use of resources, boost productivity, and improve decision-making in areas like financial management, academic planning, and student enrollment. Furthermore, robotics can be used to automate administrative duties like campus security, library services, and building upkeep in order to lessens the workload and expenses for administrative employees. Hence, emerging technologies have a lot of potential to improve not only the administrative processes, but enhance quality management that would be of benefit students and lecturers in Nigerian tertiary institutions (Duan, Edwards & Dwivedi, 2019).

Conclusion

The investigated the challenges and prospects associated with the efficacy of technology in transforming education within Nigerian tertiary institutions and found robust evidences that Fear of job disruption, inadequate technology infrastructures, insufficient allocation of funds, and shortage of trained technology professionals, privacy and security concerns, and resistance to change were some of the challenges associated with most of the tertiary institutions in Nigeria in the utilisation of the emerging technologies. In addition, the integration of these technologies possibly presents promising prospects for the transforming education in tertiary institutions in Nigeria through personalized learning experiences, enhanced teaching, transparency and accountability, collaborative research opportunities, and administrative efficiency and resource

management. Finally, it was concluded that appropriate utilization of emerging technologies such as artificial intelligence, robotics, and blockchain would offer exciting opportunities for innovative experiences in the institutions.

Suggestions

Based on the study, the following suggestions were made for addressing the challenges and maximizing the prospects of technology in transforming education for tertiary institutions in Nigeria:

1. Stakeholders in tertiary institutions should collaborate with non-governmental organizations and technology developers through continued research and development to ensure the transformation of education propelled by innovative technological advancements.
2. To ensure a smooth transition and fully utilize these technologies for the advancement of education in Nigeria, the government should take proactive measures to address the challenges that have been identified. These include integrating emerging technologies into curricula, upskilling faculty members, encouraging interdisciplinary collaboration, and emphasizing the provision of adequate funding, trained technology professionals, adherence to privacy regulations, and robust cybersecurity protocols.
3. Tertiary institutions administrators should endeavour to invest in emerging technologies like artificial intelligence (AI), robotics, and blockchain, by modernizing their technological infrastructure and providing more training for educators on tech-related resources.

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