



## A Review of Artificial Intelligence (AI) Readiness in Higher Education Institutions: A Case Study of Northern States of Nigeria

BY

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### Abstract

Artificial Intelligence (AI) has great potential to improve teaching, learning, and administrative effectiveness in higher education. Higher education institutions' readiness to use AI technologies, however, varies greatly, especially in poorer nations. The preparedness of Northern Nigerian higher education institutions for AI is examined in this review study. The review identifies important components of AI readiness through a thorough examination of the body of literature. These components include technological infrastructure, teacher readiness, curriculum integration, student participation, and policy support. The results show that even while there have been some areas of improvement, there are still major issues with inadequate infrastructure, inadequate teacher training, inadequate curriculum integration, and uneven student involvement. Furthermore, institutional support networks and policy frameworks frequently fall short of maximizing the promise of AI in education. In order to close the preparation gap, this assessment emphasizes the necessity of focused legislative interventions, improved training initiatives, and calculated technological expenditures. For stakeholders, educational administrators, and legislators hoping to develop a more AI-ready learning environment in Northern Nigeria, the ramifications of these findings are critical.

**Keywords:** AI readiness, Higher education, Northern Nigeria, Challenges, Opportunities

### Background

The field of education is not exempt from the revolutionary power of artificial intelligence (AI). Artificial Intelligence (AI) is a wide variety of technologies that mimic human thinking processes, such as robotics, natural language processing, machine learning, and data analytics (Russell & Norvig, 2016). Artificial Intelligence has several applications in higher education, including improved teaching, learning, and administrative effectiveness. Educational institutions can use AI to support creative research methods, optimize administrative processes, and improve individualized learning experiences (Holmes et al., 2019).

The potential of AI to provide personalized learning is one of its most important effects on higher education. More effective learning outcomes can be achieved by using AI-driven systems to analyze students' learning patterns and modify educational materials to suit individual needs (Nguyen et al., 2018). Adaptive learning technologies, for example, enable students to understand complicated topics at their own pace

by offering personalized content and real-time feedback. This strategy raises academic achievement and retention rates while also increasing student engagement (Woolf, 2010).

AI also plays a crucial role in administrative tasks within higher education institutions. AI-powered chatbots and virtual assistants can handle routine inquiries, streamline admissions processes, and manage student services, thus freeing up staff to focus on more complex and strategic activities (Zawacki-Richter et al., 2019). Moreover, AI-driven data analytics can aid in decision-making processes by providing insights into student enrollment trends, academic performance, and resource allocation. Such applications underscore AI's potential to enhance operational efficiency and strategic planning in higher education (Wang, 2020).

AI also encourages creative research approaches and scholarly endeavors. Researchers can find new insights and expand knowledge in a variety of domains by using AI technologies, which can handle and analyze massive datasets more efficiently than traditional methods (Jordan & Mitchell,



2015). In scientific research, for instance, AI algorithms are being used to forecast results, spot trends, and even come up with theories. This ability creates new opportunities for interdisciplinary collaboration and innovation in addition to expediting the research process (Esteva et al., 2017). In conclusion, AI has a significant impact on higher education and has the potential to revolutionize individualized learning, administrative effectiveness, and creative research.

Because of the distinct educational, economic, and technological issues that Northern Nigeria faces, which are very different from those of other regions of the country, attention to this region is essential. With lower literacy rates and fewer educational institutions than the southern areas, Northern Nigeria has always trailed behind in terms of educational progress (Adewale, 2014). The area also has socioeconomic difficulties, such as greater rates of poverty and restricted access to contemporary technology, which may impede the uptake and incorporation of cutting-edge tools like artificial intelligence in the classroom (Mustapha, 2019). In this particular context, addressing AI preparation is crucial to guaranteeing fair educational opportunities and closing the digital divide.

Additionally, developing AI skills in Northern Nigeria's universities may be crucial to regional growth, innovation, better educational outcomes, and the larger objective of national development (Usman, 2020).

## Objectives

This review's main goal is to assess the current level of AI preparedness in Northern Nigerian higher education institutions by compiling the body of research on the subject. This entails evaluating important elements inside these institutions, including the technology infrastructure, faculty readiness, curricular integration, student involvement, and policy support. The purpose of the review is to present a thorough grasp of the prospects and problems for using AI in Northern Nigerian higher education by highlighting the positives and negatives in these areas. Furthermore, the evaluation aims to provide evidence-based suggestions for stakeholders, educators, and policymakers to increase AI readiness and capitalize on its potential advantages for regional development and educational advancement (Zawacki-Richter et al., 2019; Wang, 2020). In the end, this assessment hopes to help close the technical and educational divide that exists between Northern Nigeria and more developed areas by encouraging innovation and fair access to cutting-edge learning tools.

## Methodology

### Literature Search

A thorough review of the state of AI preparation in Northern Nigerian higher education institutions was achieved through a systematic search of the literature using databases such as Google Scholar, IEEE Xplore, PubMed, JSTOR, and Scopus. These databases were selected because they offer extensive coverage of scholarly papers from a variety of fields, making it easier to find pertinent research on AI integration in higher education through 2024, especially in Northern Nigeria and

other comparable places. In order to guarantee thorough retrieval, the search employed Boolean operators in conjunction with keywords like "AI readiness," "artificial intelligence," "higher education," "Northern Nigeria," "educational technology," "infrastructure," "faculty training," "curriculum integration," "student engagement" "and" policy support." Selected peer-reviewed papers, research, and articles that provide empirical information, theoretical insights, or case studies on the subject were filtered. A number of hundred articles from the first search were vetted for relevance using abstracts and full texts; studies that addressed important themes such as faculty readiness, technology infrastructure, curriculum integration, student engagement, and policy support were chosen for inclusion in the review (Cooper, 2016; Petticrew & Roberts, 2006).

### Selection Criteria

To guarantee the quality and applicability of the reviewed literature, the selection criteria for the research that were part of this review were carefully crafted. The included studies had to focus on AI readiness or AI technology integration in higher education, provide empirical data, theoretical insights, or case studies relevant to Northern Nigeria or similar regions, and address at least one of the key themes identified, which were technological infrastructure, faculty preparedness, curriculum integration, student engagement, or policy support. The studies also had to be published in peer-reviewed journals, conference proceedings, or credible reports up until 2024. By using these criteria, higher education institutions in Northern Nigeria were to gather an extensive and superior body of literature that represented their current level of AI preparation (Cooper, 2016; Petticrew & Roberts, 2006). In order to eliminate research that did not meet quality standards or were not relevant, exclusion criteria were also established. These criteria included not having undergone peer review, concentrating on AI applications outside of higher education, lacking empirical or theoretical support, or lacking insights into the Northern Nigerian context or similar regions. To preserve uniformity, articles that were not available in English were also eliminated. These standards assisted in streamlining the selection procedure such that the final analysis contained only the most reliable and pertinent studies (Cooper, 2016; Petticrew & Roberts, 2006).

### Analysis Framework

Following the guidelines provided by Thomas and Harden (2008), a thematic synthesis approach was used to analyze the chosen literature. This approach made it possible to identify and investigate important themes that were present in a variety of research. This method entailed creating analytical themes, descriptive themes, and data coding. First, pertinent information was taken out of the chosen articles and classified according to major topics such faculty readiness, technology infrastructure, curricular integration, student participation, and policy support. According to Braun and Clarke (2006), this coding procedure was carried out methodically in order to gather all pertinent data, with guidance from the particular contexts of the studies that were examined as well as the study aims. The coded data were then combined to create

descriptive themes, which provided a thorough grasp of the state of AI readiness in Northern Nigerian higher education institutions. Analytical themes were produced by further analyzing these descriptive themes, offering more comprehensive understandings and wider ramifications for the educational environment in the area. The review provided evidence-based recommendations for future research and policy development by utilizing this structured analytical framework to synthesize a thorough understanding of the current state of AI readiness in Northern Nigerian higher education (Thomas & Harden, 2008; Braun & Clarke, 2006).

## Literature Review

### Global AI Readiness in Higher Education

There are notable differences in the state of AI preparation in higher education between different countries and universities. Universities have led the way in integrating AI technology in more developed regions such as North America and Western Europe. These universities have benefited from strong infrastructures, significant research money, and an innovative culture. For instance, with substantial funding from the public and private sectors, universities like Stanford and MIT have built specialized AI research centers and included AI into their curricula (Zawacki-Richter et al., 2019; Holmes et al., 2019). On the other hand, universities in underdeveloped nations have significant obstacles, such as inadequate resources, a lack of faculty with expertise in artificial intelligence, and inadequate infrastructure. This is especially true in Latin America, Asia, and Africa, where institutions face challenges in providing basic connectivity and access to contemporary educational technologies, which impedes the application of artificial intelligence (AI) tools (OECD, 2021).

The crucial significance that faculty development and training play in promoting AI preparedness is a theme that unites people everywhere. It is widely acknowledged that in order to successfully incorporate AI technologies into teaching practices, instructors must possess a high level of proficiency with these technologies. While Western universities have developed extensive training programs to help faculty members adjust to changing technological environments, there are few opportunities for this kind of training in developing regions, which emphasizes the need for focused capacity-building initiatives (Zawacki-Richter et al., 2019; Woolf, 2010). Furthermore, strategic frameworks and policy support are essential for fostering AI preparation in higher education. Countries that invest in educational reforms and have national AI initiatives are better positioned to reap the benefits of AI. According to Li et al. (2019), China's "Next Generation Artificial Intelligence Development Plan" places a high priority on integrating AI into education. As a result, Chinese universities have made tremendous progress in this area. Comparably, in an effort to promote cooperation among its member states, the European Union has started programs to assist AI research and application in higher education (European Commission, 2020). These policy frameworks highlight the critical role that government assistance plays in fostering innovation in education and offer an environment that is conducive to the incorporation of AI.

### AI Readiness in Developing Countries

Achieving AI preparedness in higher education presents special potential and challenges for developing nations, especially those in Africa. One of the main obstacles to adopting and effectively utilizing AI technology is the digital divide, which is defined by restricted access to internet connectivity and technological infrastructure (Kirkwood & Price, 2014; Makinde & Adeleke, 2021). These infrastructure deficiencies are made worse by underfunding technological projects, which creates major obstacles to the adoption of AI-driven teaching and learning approaches in African higher education institutions. In spite of these obstacles, African contexts provide significant prospects for the adoption of AI. With mobile devices becoming more widely available, there is a rare opportunity to bring AI-driven educational information to remote locations, which could democratize access to education and close educational gaps (UNESCO, 2019; Ally, 2009). In order to promote economic growth and innovation, African nations are also investing more in the development of their human capital and technological education. These efforts are bolstered by programs that teach professionals and students in AI-related sectors (Eneh et al., 2020; UNESCO, 2019).

Beyond physical restrictions, there are a number of important obstacles that must be addressed before African higher education institutions can become AI-ready. Building faculty capacity is essential to ensuring that teachers have the know-how to incorporate AI technology into their lessons. This process is aided by professional development courses and joint projects with business partners (Seymour & Fourie, 2019; Zawacki-Richter et al., 2019). Additionally, modernizing curricula to incorporate courses on artificial intelligence and hands-on training opportunities complies with industry standards and new technological developments, equipping students for the workforce of the future that is driven by AI (Makinde & Adeleke, 2021). Through the resolution of these issues and the utilization of existing prospects, African nations can augment AI preparedness in tertiary education and support the continent's equitable growth objectives.

### Education in Northern Nigeria

Numerous issues, such as restricted access, poor educational quality, and inadequate infrastructure, plague higher education in Northern Nigeria. These issues impede socioeconomic growth and perpetuate gaps in educational outcomes (Olaniyan & Okemakinde, 2016; Suleiman & Muktar, 2020). In comparison to the southern regions of the country, the region nevertheless experiences lower enrollment rates and a higher percentage of out-of-school children despite efforts to increase educational options. These problems are made worse by outdated curricula, inadequate finance, and a shortage of trained teachers in Northern Nigerian universities, which further lowers the quality of education offered there.

However, there are chances to enhance Northern Nigerian higher education. The demographic dividend of the regions youthful and fast-growing population can be capitalized on by making investments in skill development and education

(World Bank, 2019). The quality and applicability of higher education in the area may be improved by reforms in the education sector, such as curricular changes, teacher training initiatives, and infrastructure improvements (Adegbola, 2018). Furthermore, collaborations between academic institutions, governmental bodies, and private industry participants can tackle certain issues by offering assets, know-how, and inventive resolutions (Usman, 2020).

Moreover, Northern Nigeria's higher education could undergo a transformation thanks to technology improvements. Particularly in rural locations with poor traditional infrastructure, digital learning platforms, online courses, and educational technology can increase access to education and improve learning results (Ibrahim, 2017). Furthermore, in universities in Northern Nigeria, AI-driven tools and applications have the potential to foster research innovation and improve administrative and teaching procedures (Yahaya et al., 2021). Northern Nigeria may become a hub for superior education and knowledge generation by embracing these technological developments and creating an atmosphere that encourages creativity and teamwork.

### Key Themes and Findings Infrastructure

#### Infrastructure

The integration of artificial intelligence (AI) in higher education is significantly hampered by the current quality of the technology infrastructure in Northern Nigerian institutions. Research indicates that a significant number of universities in the area lack modern computing facilities, specialized software, and dependable internet connectivity, which makes it difficult to conduct online learning and research, especially in rural areas where sporadic and slow connections are common (Suleiman & Muktar, 2020; World Bank, 2019). Furthermore, the lack of funds for infrastructure improvements makes the technical gap worse and prevents the use of AI-driven teaching and learning strategies. Further impeding the efficient use of technology in education is the fact that the quality of the current technological infrastructure frequently falls short of international standards. Examples include out-of-date hardware, inadequate software licenses, and untrustworthy technical support services (Adegbola, 2018; Ibrahim, 2017).

Collaboration between government agencies and university officials is essential to addressing these issues. In order to provide an environment that is conducive to the integration of AI, it is imperative that investments be made in modernizing technological infrastructure, increasing internet access, and ensuring a dependable power supply (Usman, 2020; World Bank, 2019). In order to successfully solve infrastructure shortfalls, collaborations with international organizations and partners in the business sector can also mobilize resources and knowledge. Universities in Northern Nigeria can increase their ability to use AI technology by giving infrastructure development and modernization projects top priority. This would encourage creativity, teamwork, and academic success in higher education.

#### Challenges

The efficient integration of AI technology in Northern Nigerian institutions is impeded by a number of noteworthy obstacles to infrastructure development. The primary obstacle facing technology infrastructure projects is the inadequate money and investment available (Suleiman & Muktar, 2020; World Bank, 2019). University capacity to implement AI-driven teaching and learning methods is ultimately hampered by limited financial resources, which frequently compete with other priorities in government budgets and result in underinvestment in infrastructure upgrades and maintenance. Universities find it difficult to upgrade their facilities, acquire contemporary equipment, and increase internet connectivity.

In addition, administrative obstacles and bureaucratic inefficiencies make infrastructure development in Northern Nigerian institutions more difficult (Adegbola, 2018). Infrastructure projects can be delayed and their timely execution impeded by bureaucratic red tape, complex procurement procedures, and slow decision-making mechanisms. Furthermore, problems like financial mismanagement and corruption in government and educational institutions take cash away from vital infrastructural requirements, which impedes advancement even more (Usman, 2020). Furthermore, universities' ability to manage and maintain complex technological systems is hampered by a lack of skilled IT specialists and technical support workers (Ibrahim, 2017).

Without qualified staff to manage infrastructure projects, institutions could find it difficult to successfully adopt and maintain technology advancements. Furthermore, as highly skilled persons leave to more developed regions or pursue opportunities in the private sector, the brain drain problem exacerbates the lack of technical expertise inside Northern Nigerian institutions (Suleiman & Muktar, 2020). Moreover, environmental variables that impair the functioning of electronic equipment and disturb academic activities include frequent power outages, unstable power supplies, and voltage fluctuations (World Bank, 2019). Extreme weather conditions and natural disasters can also harm infrastructure, placing additional burden on the meager resources available for upkeep and repairs. Resilient infrastructure and renewable energy sources must be given top priority in order to effectively address these environmental issues.

#### Best Practices

In Northern Nigerian institutions, there have been instances of effective infrastructure improvements despite the common obstacles. These cases offer significant insights for future endeavors. Significant improvements in the region's technological infrastructure and internet connectivity have resulted from partnerships between universities and international development organizations, aided by programs financed by UNESCO and the World Bank (Usman, 2020; World Bank, 2019). These projects have made it easier to develop digital learning centers, deploy high-speed internet networks, and provide contemporary computer facilities, demonstrating the benefits of outside assistance and cooperation models in advancing technological skills.



Furthermore, some colleges in Northern Nigeria have adopted creative solutions to address infrastructure-related issues, like creating specialized ICT departments and technology hubs (Ibrahim, 2017). According to Suleiman and Muktar (2020), these initiatives facilitate the centralized management of IT resources and infrastructure development projects, hence promoting coordination and collaboration among stakeholders. Furthermore, the implementation of cutting-edge technologies like cloud computing and AI-driven solutions has been made easier by public-private partnerships (PPP) with technology and telecoms corporations (Adegbola, 2018). These partnerships give the area's infrastructure development and technological uptake a boost by giving access to funding opportunities, resources, and knowledge (World Bank, 2019). Additionally, efforts to prioritize environmental resilience and sustainability in the creation of infrastructure have shown long-term benefits, reducing the effects of unstable power supplies and environmental vulnerabilities (World Bank, 2019). By adopting eco-friendly practices and resilient infrastructure designs, Northern Nigerian institutions strengthen their capacity to ensure uninterrupted access to technology-enabled educational resources, underlining the need of holistic approaches to infrastructure development.

## Faculty Readiness

### Training and Awareness

Studies on AI awareness and faculty training programs in Northern Nigerian universities show both continuous improvement and a mixed bag of issues. Studies show that many faculty members lack formal training and awareness despite the need of providing them with AI-related skills and information (Olawale & Ogunmakin, 2020; Yahaya et al., 2021). To meet these needs, initiatives including professional development programs, workshops, and seminars have been launched with the goal of acquainting faculty members with AI principles and instruments (Yahaya et al., 2021). Through specialized training sessions, cooperative efforts between universities, industry partners, and government organizations further increase information exchange and skill development (Olawale & Ogunmakin, 2020).

Nonetheless, obstacles continue to exist in guaranteeing extensive involvement and ongoing commitment to these educational initiatives. Faculty involvement is hindered by time limits, conflicting demands, and the quick speed at which artificial intelligence is developing (Usman, 2020; Yahaya et al., 2021). Comprehensive faculty development strategies are required to address these issues. These strategies should include technical training on AI tools, pedagogical training on integration into teaching practices, and research partnerships and collaboration between disciplines initiatives (Usman, 2020; Yahaya et al., 2021). Furthermore, encouraging creative teaching and research methods in addition to cultivating a culture of lifelong learning can help Northern Nigerian schools' staff members be better prepared to integrate AI.

### Attitudes and Perceptions

In Northern Nigerian universities, the acceptance and efficacy of AI-driven educational methods are highly influenced by faculty attitudes about AI integration in the classroom. Apprehension or skepticism is expressed by some faculty members due to worries about job displacement and ethical implications, while others are positive about AI technologies as tools that can improve teaching effectiveness and streamline administrative tasks (Olawale & Ogunmakin, 2020; Yahaya et al., 2021). Faculties are more inclined to adopt AI when they believe technology will be helpful and consistent with current teaching methods (Usman, 2020). These attitudes are influenced by views of utility, simplicity of usage, and institutional support.

Faculty attitudes toward AI integration are significantly influenced by institutional support and leadership. While a lack of funds and support might result in resistance to change and skepticism, clear communication, access to resources and training opportunities, and supportive policies all contribute to favorable attitudes (Usman, 2020; Olawale & Ogunmakin, 2020). As a result, encouraging a positive institutional culture and offering sufficient support systems are essential for encouraging positive attitudes and enabling Northern Nigerian institutions to successfully implement AI-driven educational methods.

### Challenges

The successful implementation of AI-driven educational practices in Northern Nigerian institutions is hampered by a number of obstacles that impair faculty preparedness for AI integration in instruction. Faculty members' formal training and lack of experience in AI-related subjects is a major obstacle. According to studies, a large number of educators in the area may not be familiar with AI technologies or may not have the requisite training to use them successfully in the classroom (Olawale & Ogunmakin, 2020). Lack of access to tools and opportunity for professional development also makes faculty preparedness for AI integration more difficult.

Faculty preparedness for AI integration is further hampered by institutional issues like poor support networks, bureaucratic roadblocks, and inadequate infrastructure. Faculty members' ability to investigate and implement AI-driven teaching approaches is hampered by outdated equipment, inconsistent internet connectivity, and inadequate technical support services (Usman, 2020). Furthermore, faculty members may be dissuaded from devoting time and energy to AI-related projects by institutional support deficits, intricate decision-making procedures, and bureaucratic inefficiencies (Yahaya et al., 2021). In order to remove these institutional obstacles and establish a supportive atmosphere for faculty preparedness, administrators at universities, legislators, and outside stakeholders must work together.

### Current Integration

In Northern Nigerian institutions, the incorporation of AI into the curriculum is still in its early phases, with just a small number of disciplines adopting and implementing it. Although some colleges have started to provide dedicated modules on AI or include AI-related topics into their existing curriculum,

overall integration is still unequal and fragmented (Yahaya et al., 2021). According to studies, computer science and engineering departments are the main places where artificial intelligence is taught. These departments emphasize technical topics including machine learning algorithms, data analysis, and programming languages (Olawale & Ogunmakin, 2020). But there's a growing realization that AI education needs to go beyond the typical STEM subjects and incorporate interdisciplinary viewpoints and applications from a variety of fields.

Comprehensive integration efforts are hampered by issues including obsolete teaching materials, a lack of infrastructure, and professors with minimal competence, despite efforts to include AI into courses. Due to their lack of formal expertise in AI-related subjects, many faculty members may find it difficult to create and deliver curriculum with an AI focus (Usman, 2020). Curriculum integration efforts are further hampered by out-of-date textbooks, a dearth of laboratory supplies, and restricted access to cutting-edge AI tools and software (Yahaya et al., 2021).

Furthermore, it might be difficult to keep curriculum content current and relevant in light of new trends and discoveries given the quick speed at which artificial intelligence is developing. Some Northern Nigerian colleges have started implementing curriculum reform initiatives to include AI-related topics and competencies into a variety of disciplines in response to these challenges. These initiatives include updating course outlines, adding new AI-focused electives or specializations, and incorporating AI ideas and applications into already-existing courses from various academic disciplines (Olawale & Ogunmakin, 2020). Furthermore, multidisciplinary alliances and collaborations with industry stakeholders have made it easier to generate curriculum materials, experiential learning opportunities, and useful training efforts that center on artificial intelligence (Usman, 2020).

The goal of these curriculum integration projects is to give students the know-how, abilities, and competences they need to succeed in the AI-driven workforce and support economic growth and innovation. Going forward, persistent initiatives are required to support the inclusive and thorough integration of AI into the curricula of all Northern Nigerian educational institutions. This calls for funding for initiatives that promote faculty development, infrastructure improvements, curriculum design and revision procedures, and pedagogical support systems (Yahaya et al., 2021). Furthermore, encouraging corporate partnerships, stakeholder engagement, and interdisciplinary collaboration will help guarantee that AI education is grounded in real-world applications and tackles new possibilities and challenges across a range of professions.

#### Case Studies

With varied degrees of success, a number of Northern Nigerian institutions have started projects to incorporate AI into their curricula. Ahmadu Bello University (ABU) is one such example, having reformed its curriculum to include AI-related subjects in a number of academic areas. Specialized

courses in robotics, machine learning, and artificial intelligence are available at ABU's Faculty of Engineering, giving students practical experience creating AI applications (Yahaya et al., 2021). In order to assist AI education and innovation goals, the university has also established multidisciplinary research institutes and partnerships with industry players (Usman, 2020). ABU is now recognized as a pioneer in AI research and education in Northern Nigeria because to these initiatives.

Similar to this, Bayero University Kano (BUK) has partnered with international organizations and business partners to develop AI-focused elective courses and modules. Students can get basic knowledge and practical skills in AI-related domains by enrolling in courses on data analytics, pattern recognition, and AI ethics offered by BUK's Faculty of Science (Olawale & Ogunmakin, 2020). Furthermore, to advance AI education and awareness in the area, BUK's Center for Artificial Intelligence and Robotics carries out outreach, training, and research projects (Yahaya et al., 2021). These programs demonstrate BUK's dedication to developing innovation and entrepreneurship in Northern Nigeria while educating students for the workforce driven by artificial intelligence. Northern Nigerian AI education is also being aided by non-profits and educational efforts, in addition to colleges. To introduce professionals and students to AI principles and applications, the Arewa AI Hub, situated in Kaduna, for instance, hosts hackathons, workshops, and training programs (Usman, 2020). The hub works with colleges, educational institutions, and business partners to provide AI education programs that are specific to the needs and environments of each region. In a same vein, knowledge sharing, capacity building, and research collaboration in AI-related domains are encouraged by the Northern Nigeria AI Consortium, a cooperative network of universities, research institutes, and government organizations (Yahaya et al., 2021). These community-based projects support official activities aimed at promoting AI innovation and education in the area. Even though these case studies show encouraging advancements in the integration of AI in Northern Nigerian institutions, issues including inadequate funding, insufficient infrastructure, and deficiencies in faculty capacity continue to be problems. To overcome these obstacles and create a strong ecosystem for AI research and education in Northern Nigeria, cooperation, stakeholder engagement, and consistent investment are needed.

#### Recommendations

A comprehensive strategy that takes into account the needs of various stakeholders is necessary to increase the curriculum integration of AI in Northern Nigerian universities. To provide faculty with the knowledge and tools necessary for successful AI education, it is imperative that they get ongoing support in the form of faculty development grants, curriculum design workshops, and AI-focused pedagogical training (Yahaya et al., 2021). In order to guarantee that AI education is pertinent to real-world applications and developing difficulties, colleges should also encourage interdisciplinary collaborations, industrial partnerships, and stakeholder

engagement (Usman, 2020). It's also critical to improve infrastructure, give access to cutting-edge AI tools, and foster an innovative and experimental institutional culture (Olawale & Ogunmakin, 2020). By putting these tactics into practice, educators can better educate kids for the AI-driven workforce, encourage creativity, and advance the socio-economic growth of the area.

## Student Engagement

### Awareness and Attitudes

There is a diverse environment with different levels of understanding and attitudes regarding artificial intelligence, according to research on student awareness of and attitudes toward AI at Northern Nigerian institutions. Some students show great enthusiasm and curiosity in AI technologies, while others show little knowledge of them or doubt their applicability and possible effects (Yahaya et al., 2021). Research indicates that because they are exposed to similar concepts and coursework, students majoring in STEM fields—especially computer science and engineering—tend to have better levels of awareness and positive views toward artificial intelligence (Olawale & Ogunmakin, 2020). Students pursuing non-STEM careers, however, can be less familiar with AI and might have misunderstandings or concerns regarding its uses and consequences.

The educational background of students, their exposure to content relating to AI, and their opinions of the societal ramifications of AI are all factors that impact their awareness of and attitudes about AI. According to Usman (2020), students who have already encountered AI concepts or courses are more likely to have elevated awareness levels and favorable views towards AI. Furthermore, students are more likely to get involved in AI-related issues and projects if they believe AI will be relevant to their future employment or societal challenges (Yahaya et al., 2021). On the other hand, students may exhibit negative attitudes or ambivalence because to misconceptions, fears of losing their jobs, and ethical concerns about AI, especially if they have not had much exposure to AI education and training. Furthermore, it is impossible to undervalue the impact that extracurricular activities, teaching strategies, and institutional support have on students' perceptions of and attitudes toward artificial intelligence. Positive attitudes and student involvement are more likely to be fostered by universities that prioritize AI education, give access to resources and opportunity for hands-on learning, and encourage multidisciplinary collaboration (Olawale & Ogunmakin, 2020). Furthermore, programs like AI clubs, hackathons, and industry collaborations give students a chance to learn more about AI, explore its uses, and hone their practical abilities (Usman, 2020). Northern Nigerian educational institutions may improve student engagement with AI and equip students for the potential and difficulties of an AI-driven world by removing awareness obstacles and creating a conducive learning environment.

### Usage and Skills

Research conducted in Northern Nigerian educational institutions on students' use of AI tools and proficiency levels

shows that students are adopting AI technologies more widely, albeit unevenly. Some students may not have as much exposure to or access to AI tools and platforms as others, even while some actively use them for extracurricular and academic purposes (Yahaya et al., 2021). Higher degrees of expertise in using AI technologies are frequently shown by students enrolled in STEM disciplines, especially those that deal with programming, data analysis, and machine learning (Olawale & Ogunmakin, 2020). To acquire the necessary abilities, students in non-STEM disciplines would need more assistance and training as they might not be as familiar with AI technologies.

The accessibility of tools, systems of support, and opportunities for practical learning are critical factors that influence how students use AI tools and how proficient they are. Students can study and experiment with AI technologies at universities that give them access to workshops, labs, and online learning environments (Usman, 2020). Moreover, project-based learning programs, peer cooperation, and faculty mentoring support the growth of AI tool proficiency (Yahaya et al., 2021). Furthermore, extracurricular pursuits like hackathons, contests, and research projects give students excellent chances to develop their problem-solving skills and apply AI knowledge in practical settings. On the other hand, obstacles including curricular gaps, faculty expertise gaps, and infrastructure limitations can make it more difficult for students to use AI tools and acquire the necessary skills.

To guarantee thorough integration of AI-related themes and practical learning experiences, universities must invest in updating their technological infrastructure, training and supporting their teachers, and updating their curricula (Olawale & Ogunmakin, 2020). Initiatives that support business alliances, multidisciplinary cooperation, and experiential learning can also aid in bridging the knowledge gap between the classroom and real-world applications, giving students the tools they need to succeed in an AI-driven society.

### Challenges

Numerous obstacles prevent students in Northern Nigerian universities from using AI effectively, which may limit their engagement with the technology and their ability to participate in AI-related activities. Lack of infrastructure and sufficient resources for AI education and training is a major obstacle. The region's institutions suffer from a lack of AI-specific software and equipment, antiquated computer labs, and unstable internet connectivity, among other technological infrastructure issues (Usman, 2020). These infrastructural limitations limit students' access to and use of AI resources, their capacity to carry out experiments, and their ability to gain useful skills in AI applications. Furthermore, obstacles to providing students with adequate AI education and support come from a lack of faculty members with training and experience in AI-related subjects. It's possible that a large number of faculty members lack the expertise needed to mentor and advise students or effectively teach AI-related subjects (Olawale & Ogunmakin, 2020). Furthermore, a lack of specialized AI courses or elective modules may make

faculty capacity gaps worse and limit students' access to in-depth AI education and skill development.

In Northern Nigerian universities, curriculum gaps and antiquated teaching materials limit students' exposure to current breakthroughs in AI and impede their engagement with the technology. Frequent curriculum adjustments are necessary due to the rapid advancements in AI technology; nevertheless, bureaucratic procedures might impede these revisions, making it difficult for institutions to stay up with industry trends (Yahaya et al., 2021). Students also encounter psychological obstacles because they view AI as complicated and frightening and because they have prejudices, ethical questions, and worries about losing their jobs. (Olawale & Ogunmakin, 2020). These problems discourage participation, especially from people who don't know anything about AI. In order to create an environment that is supportive of AI education and overcome these obstacles, universities, legislators, industry stakeholders, and educational groups must work together. Reforming the curriculum, developing teachers, and updating the technology infrastructure are all crucial steps (Usman, 2020). Encouraging interdisciplinary cooperation, industrial collaborations, and opportunities for experiential learning help close the knowledge gap between classroom learning and practical applications, giving students the tools they need to succeed in an AI-driven future.

## Policy and Support

### Government and Institutional Policies

The National Policy on Education (NPE), a governmental initiative, offers a framework for integrating emerging technologies, including AI, into the curriculum and pedagogy of higher education institutions. The policies currently in place to support AI readiness in higher education in Northern Nigeria are still developing (National Policy on Education, 2013). The NPE emphasizes how important it is for colleges to modify their curricula to accommodate the needs of the digital era and to provide students with the knowledge and abilities required for employment in the future. However, the way AI-related policies are implemented at the institutional level can differ based on things like leadership dedication, institutional priorities, and the abundance of resources.

In addition, universities in Northern Nigeria are beginning to realize how critical it is to design institutional policies and strategies that facilitate AI innovation and readiness. As a result, some of these universities have established departments, research centers, or other initiatives dedicated to AI education, research, and development (Usman, 2020). These organizations are essential in promoting multidisciplinary collaboration, leading university AI initiatives, and supporting teachers and students involved in AI projects. However, there are still obstacles to overcome before policies can be effectively implemented and have an impact on the ground. These include capacity issues, bureaucratic roadblocks, and limited funding. As a result, governments, universities, industry stakeholders, and educational organizations must work together to support AI readiness and innovation in higher education.

### Support Mechanisms

Northern Nigerian higher education institutions can enhance their AI preparedness through partnerships, financing possibilities, and cooperation with industry and research organizations. Investments in faculty and curriculum development, infrastructure enhancements, and AI-related research activities are made possible by financial support from governments, non-profits, and industry stakeholders (Usman, 2020). Enhancing AI teaching, research, and infrastructure in universities is the goal of these funding schemes, which may include research grants, scholarships, and capacity-building efforts. Universities, industry players, and research organizations must work together to ensure that AI education meets industry needs, gives students access to cutting-edge technologies, and provides real-world experiences (Yahaya et al., 2021). Universities are constructing AI centers, labs, or hubs to support AI teaching and research; other support mechanisms include capacity-building efforts, training programs, and technical assistance (Usman, 2020). These centers provide cutting-edge resources and knowledge, and their workshops, seminars, and training programs give teachers and students the tools they need to successfully negotiate the complexity of artificial intelligence (AI), foster creativity, and advance socioeconomic development.

### Recommendations:

The research suggests a number of policy changes to promote AI preparedness in Northern Nigerian higher education institutions. First and foremost, comprehensive policy frameworks with a focus on AI education, research, and innovation should be created. These frameworks should include explicit goals, deadlines, and methods for implementation (Yahaya et al., 2021). According to Usman (2020), these frameworks ought to incorporate channels for cooperation between academic institutions, industrial stakeholders, and research organizations, as well as funding assistance and capacity-building initiatives and curricular revisions. Policies should also prioritize the development of infrastructure, which includes funding for research facilities and technology resources (National Policy on Education, 2013). Governments and educational authorities can foster an atmosphere where universities can improve their AI readiness and boost regional socio-economic growth by coordinating policies with emerging trends in AI education and research.

## Discussion

### Synthesis of Findings:

A complex picture of AI preparation in Northern Nigerian higher education institutions is shown by synthesizing literature findings. Although the value of AI in fostering creativity and educating students for the future is becoming increasingly apparent, there are still major obstacles in the way of taking meaningful action. Research highlights several impediments to the full integration of AI in higher education, including deficiencies in curriculum, attitudinal barriers, faculty ability shortages, and infrastructure (Olawale & Ogunmakin, 2020). Furthermore, variations in opportunities and resources throughout colleges aggravate the differences in AI preparation, with certain universities being ahead of the



curve and others falling behind (Yahaya et al., 2021). In order to address these issues and create an atmosphere that is supportive of AI teaching and innovation, multidisciplinary collaboration must be encouraged, and teachers and students must have access to support systems.

The research also highlights how important collaborations, financing, and regulations are to increasing AI preparation in higher education. The institutional environment is shaped by policies, which direct colleges in allocating resources and setting priorities for AI projects (National Policy on Education, 2013). Universities are more prepared for AI thanks to partnerships with business, research groups, and nonprofits that promote information sharing, cooperative research, and resource access (Usman, 2020). To effectively improve AI preparedness, a comprehensive strategy that tackles institutional, policy, and systemic issues while encouraging cooperation, innovation, and capacity-building throughout the ecosystem is required.

#### **Comparative Analysis:**

There are both parallels and differences in the strategies, difficulties, and accomplishments between Northern Nigerian institutions and those in other regions when comparing their level of AI preparedness. Because they have strong infrastructure, established AI research ecosystems, plenty of money, and business relationships, developed nations like the US, Canada, and Europe have made great strides in incorporating AI into higher education (Larson et al., 2019). On the other hand, Northern Nigerian universities struggle with issues including inadequate funding, inadequate infrastructure, and a shortage of faculty members, which makes them less competitive in the global arena when it comes to AI preparation (Usman, 2020).

However, there are similarities and differences between Northern Nigerian institutions and those in other developing countries that are working to advance AI preparation in higher education, like Sub-Saharan Africa, Southeast Asia, and Latin America (Lau, 2020). These areas have similar challenges due to a lack of finance, inadequate infrastructure, and brain drain, but they also understand how AI can propel socioeconomic growth, which has led to more investments and cooperative projects (Oyeleye et al., 2020). Targeted interventions include curriculum reforms, infrastructure enhancements, capacity-building programs, and collaborations with research organizations and industry stakeholders are crucial to addressing these issues and accelerating AI readiness (Yahaya et al., 2021).

Access to AI resources and education can also be increased by utilizing cutting-edge technology like cloud computing and online learning platforms, especially in rural areas (Usman, 2020). Institutions in Northern Nigeria may improve their AI preparedness and support global AI innovation and education by taking note of global experiences and local demands.

#### **Implications for Policy and Practice:**

The assessment of AI preparedness in Northern Nigerian higher education institutions highlights a number of consequences for institutions, educators, and policymakers. It

is recommended that policymakers give AI education and research top priority when creating national education policies. To support AI ready, collaborations, sufficient money, and supportive regulatory frameworks are required. Revision of curricula, capacity building for faculty, and infrastructural improvements are critical measures in ensuring that institutions are ready to train students for the AI-driven workforce.

By incorporating AI-related concepts, abilities, and teaching strategies into curriculum, educators play a critical role in promoting students' preparedness for AI. Programs for faculty development and multidisciplinary cooperation are essential for providing teachers with the knowledge and tools they need to teach AI. Institutions need to make investments in modernizing their infrastructure, creating AI research facilities, and creating welcoming workplaces in order to promote creativity and teamwork. Access to AI resources and education can be further expanded by utilizing cutting-edge technology, such as online learning platforms, especially in rural areas. Ultimately, to fully utilize AI's revolutionary potential for socioeconomic development and global competitiveness, a coordinated approach is required.

#### **Conclusion:**

In a Nutshell, this evaluation has looked at how prepared Northern Nigerian higher education institutions are for AI, pointing out issues including inadequate infrastructure, staff shortages, curriculum flaws, and hurdles rooted in student attitudes. Despite these challenges, there are ways to make improvements with focused interventions and support systems. To improve AI readiness, policymakers, educators, and institutions must work together to execute faculty development efforts, infrastructural investments, and strategic policy reforms institutions in Northern Nigeria can increase their ability to take advantage of AI's revolutionary potential for socioeconomic development and innovation by coordinating policies, procedures, and resources with the latest trends and best practices in AI education and research. In the end, increased AI preparedness in higher education would need coordinated efforts from all stakeholders, allowing Northern Nigeria to prosper in an AI-driven future and contribute to global innovation and competitiveness.

#### **Future Research Directions**

Future studies on AI readiness in Northern Nigerian higher education institutions should concentrate on using empirical and longitudinal research to evaluate the impact of AI-related interventions on student engagement, faculty preparedness, and curriculum integration. It ought to investigate the disciplinary differences in AI readiness between STEM and non-STEM domains, as well as the possibility of interdisciplinary cooperation in industries such as business, healthcare, and agriculture. To identify best practices for enhancing AI education and innovation, it is also important to look into the role that technology-enhanced learning environments and online platforms play in increasing access to AI education. These studies should also look into the

effects that funding, institutional support, and policy reforms have on AI readiness.

## Final Thoughts

Even while Northern Nigerian higher education has made progress toward being AI-ready, issues like inadequate curriculum, teacher capacity shortages, infrastructure limitations, and impediments related to students' attitudes still exist. Revisions to policies, focused interventions, and cooperative projects can all lead to better outcomes. Aware of the significance of artificial intelligence (AI) for socio-economic advancement, stakeholders are giving priority to AI research and education, with support from financing, policy measures, and capacity-building programs. There is room for improvement as the ecosystem of AI-related activities is expanding. In order to maximize AI's revolutionary potential for regional and global advancement, a multifaceted strategy that includes policy support, infrastructure investments, faculty development, curricular reforms, and partnerships is vital going forward.

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