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EXPLORING THE POTENTIAL BENEFITS AND ETHICAL IMPLICATION OF INTEGRATING ARTIFICIAL INTELLIGENCE INTO TECHNICAL EDUCATION PROGRAMME IN KANO STATE TERTIARY INSTITUTIONS

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Abstract

The study explored the potential benefits and ethical implications of integrating artificial intelligence into technical education programme in Kano State tertiary institutions. Two research questions guided the study and two null hypotheses were tested. The study adopted the descriptive survey design. The population of the study comprised 1,266 Technical education students in the five government tertiary institutions in Kano State that run technical education programme. Simple random sampling technique was used to obtain a sample size of 300 from technical education students. A 16-item structured questionnaire was used for the study. Three research experts validated the questionnaire instrument. The reliability of the items instrument was ensured using pilot test method and data obtained were analyzed using Cronbach alpha. The analysis yielded an overall reliability coefficient of 0.92 which was suitable for the study. Mean and standard deviation were used to answer the research questions while Analysis of Variance was used to test the hypotheses at a significance level of 0.05. The findings of the study revealed that AI-empowered systems facilitate personalized-learning, enable adaptive learning and real-time feedbacks on learning progression. However, AI ethical concerns in education were identified to include but not limited to: data privacy and security, algorithmic bias, unfairness, among others. The study concluded that AI-powered personalized and adaptive learning platforms are crucial in education because they analyze individual student data to customize learning paths, materials, and pace, ultimately improving engagement, motivation and academic outcomes. It was recommended that AI technology developers and regulatory bodies should ensure that they engaged in the implementation and enforcement of data privacy regulations to safeguard personal information.

Keywords: *Benefits of Artificial Intelligence, Ethical Implication, Education, Technical Education, Nigerian Tertiary Institutions*

Introduction

Artificial Intelligence (AI) is rapidly transforming the education sector by introducing innovative solutions that enhance learning experiences and streamline administrative processes. Rather than replacing traditional pedagogical methods, AI complements them, using technologies such as machine learning to offer personalized learning paths and improved access to quality information. As Afolayan and Ajayi (2019) note, AI encompasses a collection of technologies capable of simulating human intelligence and behavior, with broad applicability across multiple domains, including education. In educational contexts, AI integration has revolutionized teaching and learning, significantly influencing learning outcomes.

In Nigerian tertiary institutions, AI offers numerous potential benefits for technical education, including personalized learning, administrative efficiency, intelligent tutoring systems, smart content creation, and democratized access to resources through AI-powered tools. AI-enabled platforms use machine learning algorithms to adapt to individual learning needs, track progress and provide tailored feedback. These systems enhance student engagement, motivation, and overall academic performance. Adewale and Akintola (2018) highlight that machine learning focuses on building systems capable of

making predictions based on data and continuously improving performance. Algorithms, the foundation of AI tools, define the rules computers follow to solve problems, offering structured pathways for personalized and adaptive learning (Dignuim, 2018).

Personalized learning platforms leverage AI to customize educational experiences based on student performance data. By tailoring content, feedback, and learning pace to each student, these platforms shift away from standardized models toward more flexible, dynamic approaches. According to Nwagbara (2024), such platforms facilitate transformative learning by identifying knowledge gaps, providing timely interventions and supporting students' unique needs. AI tools also reduce the workload for educators by automating assessments, tracking progress, and monitoring behavioral insights through facial recognition and other analytics.

Education itself is a dynamic process aimed at developing critical thinking, creativity, and skills necessary for success in a complex society. Ogunleye and Awoniyi (2020) describe education as the systematic cultivation of intellectual and emotional resilience through lifelong learning. Integrating AI into education enhances this process by nurturing individual talents, providing tailored learning opportunities, and facilitating adaptive learning environments (Adewale and Akintola, 2018; Chu et al, 2022). AI tools, including virtual classrooms, further promote collaborative learning, participation, and timely feedback.

Despite these advantages, AI integration raises ethical concerns, particularly regarding data privacy, algorithmic bias, fairness, transparency and accountability. Ono et al (2025) emphasize that unequal access to AI tools can exacerbate socio-economic disparities, creating educational gaps among disadvantaged learners. The widespread collection of student data intensifies privacy and security risks, particularly in technical education, where sensitive information is collected, analyzed, and utilized to optimize learning outcomes. Baker (2023) highlights the need for data protection regulations to prevent misuse, while Mario and Ayala (2023) stress balancing AI benefits with equity, fairness and trust in educational environments.

Technical education at the tertiary level prepares students for careers by combining academic knowledge with practical skills. It includes career exploration, life skills development, and preparation for industry-specific roles. Odu (2021) defined technical education as a subset of vocational training aimed at producing skilled labor, while Amadi and Brown (2023) note its role in equipping students for engineering, computer science, culinary arts, and other specialized fields. However, challenges such as digital literacy gaps, inadequate training, and resistance to technological change hinder effective AI integration in Nigerian technical education. Amadi and Brown (2023) found significant differences in educators' perspectives on AI use depending on teaching experience, highlighting uneven adoption across institutions.

Institutional type also influences AI adoption and its perceived benefits. Universities, polytechnics, and colleges of education differ in infrastructure, resources, and student populations, affecting technical students' experiences with AI tools. Nwagbara (2024) reported significant variations in students' perceptions of AI's potential benefits and ethical implications across different tertiary institutions.

Privacy violations, algorithmic bias, and inequitable access are persistent ethical concerns. AI systems that monitor student activities raise issues of autonomy, trust, and fairness, potentially undermining the very benefits they provide. Thoughtful design, regulation, and monitoring are essential to ensure AI enhances learning while minimizing ethical risks. This study examines the potential benefits and ethical implications of AI integration in technical education programmes within tertiary institutions in Kano State, Nigeria, aiming to provide insights that can guide effective and equitable adoption.

Statement of the Problem

The integration of Artificial Intelligence (AI) into technical education programmes in tertiary institutions in Kano State, Nigeria has the potential to enhance teaching, learning and administrative efficiency. AI tools, such as personalized learning platforms, intelligent tutoring systems, and data-driven analytics, can improve student engagement, optimize learning outcomes and streamline educational processes. However, several challenges limit its effective adoption. The key obstacles

include infrastructure and digital literacy gaps**,** which restrict equitable access to AI technologies, particularly in polytechnics and colleges of education. Ethical concerns, such as data privacy violations, algorithmic bias, and misuse of student information, may undermine trust and exacerbate socio-economic disparities. Additionally**,** resistance to technological change among educators and students contributes to uneven implementation and limits the effectiveness of AI in enhancing learning outcomes.

Moreover, there is limited empirical evidence on AI's actual impact on technical education in Nigeria, particularly regarding learning outcomes, career readiness and ethical compliance. This gap hinders policymakers and educators from leveraging AI's full potential or addressing associated risks. Therefore, this study examines the potential benefits and ethical implications of AI integration in technical education programmes in tertiary institutions in Kano State, Nigeria, to guide effective, equitable and responsible adoption.

Research Questions

The following research questions guided the study:

1. What are the benefits of AI integration in technical education programme Kano State tertiary institutions?
2. What are the ethical implications of AI integration in technical education programme Kano State tertiary institutions?

Hypotheses

The following null hypotheses were tested at alpha level of 0.05:

1. There is no significant difference in the mean responses of technical education students in universities, polytechnics and colleges of education on the benefits of AI integration in technical education programme Kano State.
2. There is no significant difference in the mean responses of technical education students in universities, polytechnics and colleges of education on the ethical implications of AI integration in technical education programme Kano State.

Methods

Descriptive survey research design was adopted for the study. The population for the study comprised 1,266 Technical education students in the five government tertiary institutions in Kano State that run technical education programme. The institutions are the Bayero University Kano (72); Kano State Polytechnics (109); Northwest University Kano (581); Kano State University of Science and Technology (138) and Federal College of Education (Technical), Bichi (366). Simple random sampling technique was employed to obtain a sample size 300, comprised of 100 college of education, 50 polytechnic and 150 university technical education students. A 16 items structured questionnaire was used for the study. The questionnaire items instrument was validated by three experts, two experts in Technical Education, Federal College of Education (Technical), Bichi, Kano State, Nigeria. To establish the instrument's reliability, pilot testing was utilized. The internal consistency of the items instrument was established using Cronbach Alpha and yielded reliability co-efficient values of 0.91 and 0.93 respectively for the two clusters with an overall co-efficient value of 0.92. Data collected in the study regarding the two research questions were analyzed using descriptive statistics of mean and standard deviation. Mean value was used to answer the two research questions while the standard deviation was used to determine the closeness of the mean responses. Decision on the questionnaire items were interpreted on means, any mean score of 2.50 and above were considered agreed while the mean scores below 2.50 were considered disagreed. In data collection, out of the 300 copies of the questionnaire distributed to the respondents, 294 copies were actually retrieved from the respondents which represented about 98 percent. Six copies were not properly filled and discarded representing 2 percent. Analysis of Variance was to test variables that are more than two groups. A null hypothesis was rejected where the calculated p-value was less than the 0.05 level of significance; it means that

there is a significant mean difference. Conversely, where the calculated p-value is greater than or equal to the level of significance (0.05), it means that there was no significant mean difference and the hypothesis is not rejected.

Results

Research Question 1: What are the benefits of AI integration in technical education programme in Kano State tertiary institutions?

Table 1*: Mean Rating of Technical Education Students on the Benefits of AI Integration in Technical Education Programme in Kano State Tertiary Institutions N=294*

S/N	Items Statements	$\overline{X}$	SD	Remarks
1.	AI provides me with individualized performance progress	3.50	0.47	Agree
2.	The adaptive learning platform fits into my learning preference	2.10	0.64	Disagree
3.	The learning platforms effectively identifies and address my learning strengths and weaknesses	3.60	0.42	Agree
4.	I gets timely feedback from AI learning platforms	3.57	0.44	Agree
5.	Relevant resource materials are provided in the learning platforms based on learning needs	2.33	0.61	Disagree
6.	I am motivated in my career due to the help of AI applications	3.13	0.52	Agree
7.	I am not satisfied with the feedbacks gotten from the AI learning platforms	2.06	0.67	Disagree
8.	Through AI assessment platforms evaluating my learning progress is made easy	3.40	0.50	Agree

Data in Table 1 show that the respondents agree on five items out of the eight items listed above with mean scores ranging from 3.13 to 3.60. This is because its mean score was above 2.50 which is the cut of point. The result reveals that technical education students in Kano State tertiary institutions do access AI-empowered learning platforms. This implies that personalized and adaptive learning platforms are benefits, often utilized and enhances learning outcomes of technical education students in Kano State tertiary institutions. The respondents disagree on the remaining three items with mean scores ranging from 2.06 to 2.33. The standard deviations show that there is homogeneity amongst responses indicating a greater consensus of opinions.

Research Question 2: What are the ethical implications of AI integration in technical education programme in Kano State tertiary institutions?

Table 2*: Mean Rating of Technical Education Students on the Ethical Implications of AI Integration in Technical Education Programme in Kano State Tertiary Institutions? N=294*

S/N	Items Statements	$\overline{X}$	SD	Remarks
9.	I do have full access to AI- learning tools	3.50	0.47	Agree
10.	AI-algorithms prioritize security of data	3.10	0.54	Agree
11.	My school has some measures put in place to ensure AI-driven data privacy	2.15	0.62	Disagree
12.	I don’t share sensitive information online due to data insecurity	3.57	0.44	Agree
13.	There are potential risks of data privacy and security in AI learning platforms	3.63	0.41	Agree
14.	AI-algorithms prioritize security of data	3.43	0.52	Agree
15.	I personally manage my privacy setting to control			

	the use of data by others	2.02	0.67	Disagree
16.	There is no transparency and accountability in AI learning platforms	2.40	0.60	Disagree

Data in Table 2 show that the respondents agree on five items out of the eight items listed above with mean scores ranging from 3.10 to 3.63. This is because its mean score was above 2.50 which is the cut of point. The result reveals that there are ethical implications of AI integration in technical education programme in Kano State tertiary institutions. This signifies those issues such as data privacy and security, algorithm bias, unfairness among others is associated with AI integration in technical education programme in Kano State tertiary institutions. The respondents disagree on the remaining three items with mean scores ranging from 2.02 to 2.40. The standard deviations show that there is homogeneity amongst responses indicating a greater consensus of opinions.

Hypothesis 1: There is no significant difference in the mean ratings of technical education students in universities, polytechnics and colleges of education on the benefits of AI integration in technical education programme in Kano State tertiary institutions.

Table 3*: Summary of ANOVA on the Mean Ratings of Technical Education Students in Universities, Polytechnics and Colleges of Education on the Benefits of AI Integration in Technical Education Programme in Kano State Tertiary Institutions*

Source of Variance	Sum of Squares	Df	Mean Square	F-ratio	P-value	Remarks
Between Groups	23.583	2	2.282	20.263	.000	Significant
Within Groups	929.417	291	2.119			
Total	952.000	293				

A one-way Anova was conducted in Table 3 to determine whether a significant difference exists in the mean ratings of technical education students in universities, polytechnics and colleges of education on the benefits of AI integration in technical education programme in Kano State tertiary institutions. The results indicate a significant difference {F (2,308) = 20.263, *P*= .000} is less than the stipulated 0.05 level of significance (*P*-value < alpha level). It is therefore revealed that there is a significant difference in the mean ratings of technical education students in universities, polytechnics and colleges of education on the benefits of AI integration in technical education programme in Kano State tertiary institutions. Therefore, the null hypothesis is rejected.

Hypothesis 2: There is no significant difference in the mean ratings of technical education students in universities, polytechnics and colleges of education on the ethical implications of AI integration in technical education programme in Kano State tertiary institutions.

Table 3: *Summary of ANOVA on the Mean Ratings of Technical Education Students in Universities, Polytechnics and Colleges of Education on the Ethical Implications of AI Integration in Technical Education Programme in Kano State Tertiary Institutions*

Source of Variance	Sum of Squares	Df	Mean Square	F-ratio	P-value	Remarks
Between Groups	11.043	2	2.423	21.183	.078	Not Significant
Within Groups	231.515	291	2.109			
Total	242.558	293				

A one-way Anova was conducted in Table 4 to determine whether a significant difference exists in the mean ratings of technical education students in universities, polytechnics and colleges of education on the ethical implications of AI integration in technical education programme in Kano State

tertiary institutions. The results indicate a significant difference {F (2,308) = 21.183, *P*= .078} is greater than the stipulated 0.05 level of significance (*P*-value > alpha level). It is therefore revealed that there is no significant difference in the mean ratings of technical education students in universities, polytechnics and colleges of education on the ethical implications of AI integration in technical education programme in Kano State tertiary institutions. Therefore, the null hypothesis is not rejected.

Discussion

Findings of the study revealed that technical education students in Kano State tertiary institutions do access AI-empowered learning platforms. This implies that personalized and adaptive learning platforms are benefits, often utilized and enhances learning outcomes of technical education students in tertiary institutions. This finding is in line with Nwagbara (2024) who affirmed that the transformative learning experiences through the personalized learning platforms has contributed greatly to the overall improvement in learning processes by identifying areas of improvement and profile timely solution.

The findings of the study further revealed that there was a significant difference in the mean ratings of technical education students in universities, polytechnics and colleges of education on the benefits of AI integration in technical education programme in Kano State tertiary institutions. This agrees with the findings of Nwagbara (2024) who reported that there was a significant difference in the views of technical education students in universities, polytechnics and colleges of education on the potential benefits of Artificial intelligence in technical education programme. The study indicates that technical education institutions often face significant challenges regarding inadequate facilities, equipment, and overall infrastructure, which could lead to similar learning difficulties, but there is no direct evidence to suggest these issues are the explicit reason for "similarities in test of hypotheses."

Findings of the study revealed that technical education students in Kano State tertiary institutions reveal that there are ethical implications of AI integration in technical education programme. This signifies those issues such as data privacy and security, algorithm bias, unfairness among others is associated with AI integration in technical education programme in Kano State tertiary institutions. This finding is in line with Ono (2025) who revealed that their issue of unequal access to AI educational tools could cause socio-economic disparities, thus creating educational gaps especially among the disadvantaged learners.

The findings of the study further revealed that there is no significant difference in the mean ratings of technical education students in universities, polytechnics and colleges of education on the ethical implications of AI integration in technical education programme in Kano State tertiary institutions. This agrees with the findings of Ogunleye and Awoniyi (2020) who affirmed that AI-algorithms perpetuate bias and inequalities that lead to the exclusion of learners, especially if the systems are not carefully designed and monitored for equitable access. The study implies that a lack of significant data protection regulations for technical education students in universities, polytechnics, and colleges of education leads to dissimilarities in hypothesis testing results.

Conclusion

Based on the findings of the study, it is concluded that AI-powered personalized and adaptive learning platforms are crucial in education because they analyze individual student data to customize learning paths, materials, and pace, ultimately improving engagement, motivation, and academic outcomes. These platforms move beyond a one-size-fits-all model by providing tailored instruction that helps students master concepts at their own speed. More importantly the AI-interactive learning tools can promote critical thinking and collaborative learning through personalized, adaptive feedback, interactive simulations and structured group activities. However, their integration also presents challenges, including algorithmic bias, unequal access to data and technology, data privacy and security risks, and a lack of transparency in decision-making processes.

Recommendations

The following recommendations were made by the researcher based on the findings of the study:

1. AI technology developers and regulatory bodies should ensure that they engaged in the implementation and enforcement of data privacy regulations to safeguard personal information. These efforts involve implementing technical measures like robust data encryption and ongoing review of governance models to adapt to evolving AI capabilities and protect user data effectively. The development of comprehensive frameworks and policies remains an ongoing priority within the tech industry and governmental sectors.
2. Surveillance mechanism embedded in AI's predictive systems and AI-personalized platforms should be actively automated by students for prompt identification of learning patterns and areas of improvement and profile timely solution for the overall contribution and improvement in learning processes.
3. AI-algorithmic systems should be carefully designed and monitored for equitable access to avoid inequalities that could cause socio-economic disparities, thus creating educational gaps that may lead to the exclusion of learners.

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