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AI-DRIVEN TRANSFORMATION OF WOODWORK TECHNOLOGY EDUCATION FOR SUSTAINABLE WORKFORCE DEVELOPMENT IN TERTIARY INSTITUTIONS IN LAGOS STATE

[1]Dr. Shobowale, I. Olukayode, Ph.D, & [2]Falowo, T. Henry
[1]Department of Technology and Vocational Education, University of Lagos, Akoka, ishobowale@unilag.edu.ng;
[2]Department of Woodwork Technology Education, Federal College of Education (Technical), Akoka, henryfalowo@gmail.com

Abstract
This study investigated the AI-driven transformation of Woodwork Technology Education for sustainable workforce development in Lagos State, Nigeria. It evaluated the extent of artificial intelligence (AI) integration, its influence on practical skill acquisition, and the technical bottlenecks hindering its adoption within technical and vocational education and training (TVET) frameworks. A descriptive survey design was adopted, utilizing a total enumeration technique to capture 43 specialized respondents (13 facilitators, 30 industrial experts). Primary data collected via a structured questionnaire (AIDT-WTESWDQ) yielded sub-scale Cronbach's alpha coefficients from 0.84 to 0.87. Data were analyzed using mean and standard deviation descriptive statistics against a 3.50 criterion threshold. Findings revealed that AI-driven tools, like cloud-based CAD simulations, significantly enhance technical skills and graduate employability, actual current integration remains low and confined to theoretical applications. Descriptive analysis verified erratic public power supply, inadequate software funding, and low internet bandwidth actively neutralize these digital learning paths during workshop sessions. The study concluded that operational success depends entirely on dismantling these infrastructural deficits. The study recommended that institutions prioritize alternative energy installations and localized offline servers, establish public-private software partnerships, and collaborate with the National Board for Technical Education (NBTE) to mandate a balanced digital-to-physical curriculum split.

Keywords: AI, Digital Transformation, Woodwork Technology Education, Sustainable Workforce Development, Technical Skill Acquisition.

Introduction
Education remains the cornerstone of human capital development, operating through both formal and non-formal pathways. Formal education relies on structured, institution-based curricula, while non-formal pathways emphasize flexible, demand-driven skill acquisition. In Nigeria, this dual structure is guided by the Federal Government of Nigeria (FGN) National

Policy on Education, which positions Technical and Vocational Education and Training (TVET) as a strategic tool for economic self-reliance. Within this framework, entrepreneurial education is embedded to equip learners with business acumen, enabling them to transform technical competencies into viable commercial ventures (Oviawe, 2020). A critical curricular program in tertiary TVET is Woodwork Technology Education (WTE), designed to provide students with cognitive and psychomotor skills in carpentry, joinery, and advanced furniture design.

Globally, the wood and furniture industry is undergoing rapid digital transformation, driven by advanced computerized machinery, automation, and artificial intelligence. This shift demands that graduates possess digital design literacy alongside traditional tactile skills (Audu & Okoro, 2022). Regionally, Nigerian TVET institutions must adapt to these evolving demands to remain relevant. Such adaptation aligns with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 8 (Decent Work and Economic Growth), by promoting sustainable, technology-driven workforce development (Oviawe & Ogbebor, 2024). Thus, integrating AI into WTE is not merely a technological upgrade but a strategic imperative for aligning education with global industrial trends.

Despite these imperatives, Nigerian tertiary WTE programs face persistent challenges. Workshops are often equipped with obsolete tools, and program structures lag behind industrial realities (Umar et al., 2024). These deficiencies expose significant gaps in Technological Pedagogical Content Knowledge (TPACK), where instructors possess strong content knowledge (CK) in woodwork but lack the technological pedagogical knowledge (TPK) necessary to integrate modern digital tools (Schmidt-Crawford et al., 2023). The rapid emergence of AI applications further complicates this gap, requiring a structural overhaul of pedagogical delivery to simulate human cognitive processes and automate complex design and production tasks (Sanusi, Ayanwale, & Oyelere, 2023).

Although existing TVET frameworks and FGN policies advocate for industrial alignment, practical integration of AI remains constrained. Current delivery models are largely theoretical, with limited exposure to digital simulations or AI-driven design optimization. Yet, AI offers powerful opportunities for skill development, including virtual mentorship, automated design refinement, and predictive modeling for sustainable production (Ebelechukwu & Umeokafor, 2024). These opportunities highlight the urgency of bridging manual craftsmanship with smart manufacturing, ensuring that workforce development in Lagos State tertiary institutions aligns with dynamic industrial demands.

The rationale for this study lies in addressing this critical transition. By investigating the extent of AI integration in WTE, identifying institutional bottlenecks, and evaluating its influence on skill acquisition, the study seeks to provide actionable insights for sustainable workforce development. Ultimately, the research underscores the need for a balanced digital-to-physical curriculum, supported by infrastructural reforms and strategic partnerships, to prepare graduates for the realities of a technology-driven woodwork industry.

Statement of the Problem

Th e rapid transition of the global Technical and Vocational Education and Training (TVET) landscape toward smart automation has placed Woodwork Technology Education (WTE) at a critical crossroads. Internationally, WTE is evolving beyond manual carpentry into high-precision robotics, automated digital production, and smart manufacturing. Locally, however, Nigerian woodwork craftsmanship continues to struggle with inferior design, poor finishing, and weak packaging. This quality deficit fuels consumer preference for imported products, undermining the competitiveness of the domestic industry. Addressing this challenge requires integrating advanced digital design technologies into WTE, yet a significant research and practice gap persists regarding how Artificial Intelligence (AI) can realistically be leveraged to upgrade student competencies.

This technological shortfall is closely tied to pedagogical stagnation within the Technological Pedagogical Content Knowledge (TPACK) framework. While instructors possess strong content knowledge (CK) in woodwork, they lack the technological pedagogical knowledge (TPK) needed to integrate modern AI tools effectively. Industry-standard applications such as AI-driven AutoCAD generative design plugins, Adobe Creative Cloud, and similar platforms remain inaccessible due to prohibitive licensing costs, often ranging between ₦1.38 million and ₦2.07 million ($1,000–$1,500 USD) per user annually (Adobe Inc., 2026; Autodesk Inc., 2026). Consequently, tertiary institutions rely on restricted trial versions that limit exposure to advanced workflows, depriving students of meaningful digital design experiences (Audu & Okoro, 2022).

Beyond software, hardware constraints further compound the problem. Running advanced AI platforms requires high-performance graphics processing units (GPUs), which are largely absent in local workshops. This hardware and software deficit confines learners to outdated design theories, stifling creativity and innovation. The crisis is intensified by a policy gap: current TVET regulatory frameworks lack clear guidelines for funding, licensing, or integrating AI into woodwork pedagogy. Chronic institutional bottlenecks underfunded IT departments, poor infrastructure maintenance, and centralized administrative delays sustain this neglect.

Without targeted reforms to subsidize AI software, upgrade workshop hardware, and embed digital literacy into curricula, Nigerian tertiary institutions will continue to graduate WTE students lacking modern competencies. This study therefore investigates how strategic AI integration can overcome these barriers, bridging manual craftsmanship with smart manufacturing to rescue local woodwork education from industrial obsolescence.

Purpose of the Study

The main purpose of this study is to examine how the AI-driven transformation of Woodwork Technology Education can enhance sustainable workforce development in tertiary institutions in Lagos State. Specifically, the study sought to:

1. Determine the current extent of AI tool integration within the instructional deliver and workshop practices in tertiary institutions in Lagos State.
2. Evaluate the influence of AI-driven tools on students' technical skill acquisition during woodwork practices in tertiary institutions in Lagos State.
3. Assess the institutional and technical challenges hindering the adoption of AI-driven instructional delivery and wood workshop practices in tertiary institutions in Lagos State.

Research Questions

The study was guided by the following research questions:

1. What is the current extent of AI tool integration within the instructional delivery and workshop practices in tertiary institutions in Lagos State?
2. What is the influence of AI-driven tools on students' technical skill acquisition during woodwork practices in tertiary institutions in Lagos State*?*
3. What are the institutional and technical challenges hindering the adoption of AI-driven instructional delivery and wood workshop practices in tertiary institutions in Lagos State?

Theoretical/Conceptual Framework

The pedagogical and practical integration of AI within Woodwork Technology Education is grounded in the Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2006) and refined for digital learning ecosystems (Schmidt-Crawford et al., 2023). The framework conceptualizes effective teaching as the intersection of Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK), with its key principle being that technology integration is not a stand-alone skill but a dynamic process that reshapes how content is taught and understood. The framework assumes that teachers must simultaneously master subject matter, pedagogy, and technology to deliver meaningful instruction. In this study, CK refers to woodwork design and joinery, PK to instructional methods for skill transfer, and TK to AI-driven AutoCAD and CAD/CAM tools. The intersections TPK and TCK illustrate how technology transforms both pedagogy and content delivery. This study extends TPACK by situating it within AI-enhanced Woodwork Technology Education (WTE), showing how intelligent simulations and generative design tools bridge abstract geometry with practical workshop execution. The justification for using TPACK lies in its diagnostic capacity: it highlights how institutional constraints on technological access hinder instructors from translating traditional craftsmanship into digital design practices, making it a critical lens for analyzing AI integration in WTE.

Human Capital Theory (HCT), pioneered by Schultz (1961) and Becker (1964), frames education as an investment that enhances individual productivity and yields economic returns. Its central assumption is that deliberate training and skill acquisition increase employability and resilience in dynamic labor markets. The theory argues that without continuous upskilling, workers face depreciation of their human capital and structural unemployment. Applied to this study, HCT explains the relationship between AI-driven technical instruction and sustainable

employability in automated manufacturing contexts. As traditional woodwork skills lose relevance, exposure to predictive design software and automated workflows elevates trainees' human capital value, converting artisan competencies into automation-ready expertise. This study extends HCT by contextualizing it within Lagos State's socio-economic landscape, where digital-tactile skills are essential to offset reliance on foreign imports and mitigate graduate unemployment. The justification for using HCT is its ability to provide an economic rationale for AI-based instructional reform: it positions digital skill acquisition not merely as classroom innovation but as a strategic national investment in workforce sustainability and industrial competitiveness.

Methodology

This study adopted a descriptive survey research design. As Creswell and Creswell (2018) explain, survey designs are particularly suited for providing quantitative descriptions of trends, attitudes, and opinions within a defined population. This approach was appropriate for systematically eliciting, mapping, and analyzing respondents' perceptions of existing educational conditions without the experimental manipulation of variables. Consequently, this design was uniquely suited for evaluating the baseline extent of AI tool integration, identifying systemic hindrances, and evaluating the concurrent implications of this technology-driven transformation for woodwork technology skill acquisition within Lagos State.

The study was conducted across selected tertiary institutions and registered woodwork industries within Lagos State, South-West Nigeria. The institutional framework comprised the University of Lagos (UNILAG), Yaba College of Technology (YABATECH), and the Federal College of Education (Technical), Akoka, paired with structurally operational furniture and woodwork enterprises cluster-located within the Yaba Local Government Area. These target sites were purposively selected due to their centralized role in technical teacher education, advanced workshop-based instructional delivery, and modern industrial woodwork practices undergoing digital transition.

The target population of the study consisted of 43 specialized respondents, comprising 13 Woodwork Technology Education lecturers/facilitators and 30 industrial experts drawn from the selected registered wooden furniture-making enterprises. Given the highly specialized, relatively compact, and completely accessible nature of this population, a total enumeration (census) sampling technique was deployed. This non-probabilistic approach eliminated sampling error by capturing the entire defined universe of eligible respondents (N = 43), thereby optimizing data representativeness. Primary data was collected using a structured, researcher-developed instrument titled the *AI-Driven Transformation of Woodwork Technology Education for Sustainable Workforce Development Questionnaire* (AIDT-WTESWDQ). The instrument items were generated from an extensive literature matrix and categorized into three main thematic parts explicitly matching the research questions: *Part A***:** Evaluated the current extent of AI tool integration within instructional delivery and workshop practices. *Part B***:** Measured the influence of AI-driven instructional tools on students' technical skill acquisition during woodwork

practices. *Part C:* Identified the institutional and technical challenges hindering the adoption of AI-driven instructional delivery and wood workshop practices. Responses across all parts were anchored on a five-point Likert scale, continuously scored from Strongly Agree (5), Agree (4), Undecided (3), Disagree (2), to Strongly Disagree (1).

To establish psychometric validity, the instrument was subjected to rigorous face and content validation by a panel of three independent experts: one specializing in TVET, one from Educational Measurement and Evaluation, and one from wooden furniture-making enterprises. Their structural feedback was integrated to refine item syntax, construct alignment, and conceptual density. To ascertain reliability, a pilot study was conducted with 10 technical facilitators and industrial experts in a neighboring state outside the primary study domain. The internal consistency of the instrument was computed using Cronbach's Alpha coefficient, yielding strong, empirically acceptable coefficients across the targeted sub-scales: $\alpha = 0.84$ for the extent of AI tool integration (Part A), $\alpha = 0.87$ for the influence on technical skill acquisition (Part B), and $\alpha = 0.86$ for institutional and technical challenges (Part C), thereby confirming high instrument reliability and stability.

Ethical considerations were strictly maintained through informed consent protocols, guaranteed voluntary participation, institutional anonymity, and data confidentiality. Data collected were processed using mean ($\bar{X}$) and standard deviation (SD) descriptive statistics to answer all three research questions. For these descriptive measures, a criterion mean decision benchmark was mathematically fixed at a strict threshold of 3.50. A mean score of 3.50 or above ($\bar{X} \geq 3.50$) indicates agreement that the practice occurs to a High Extent, while a mean score below 3.50 ($\bar{X} < 3.50$) indicates disagreement, representing a Low Extent of integration. The standard deviation was used to ascertain the homogeneity or variability of the respondents' scores around the calculated mean vectors, where an SD less than 1.00 indicated high consensus among the respondents.

Results

Research Question 1: What is the current extent of AI tool integration within the instructional delivery and workshop practices in tertiary institutions in Lagos State?

Table 1: Mean and Standard Deviation on current extent of AI tool integration within the instructional delivery and workshop practices in tertiary institutions in Lagos State. (N = 43)

S/N	AI Tool Integration Metrics: Instructional and Workshop Environments	M	SD	Decision
1.	Personal mobile-based conversational AI assistants (e.g., ChatGPT, Copilot) are utilized by students to brainstorm woodwork design concepts and joinery methods.	3.92	0.62	Agreed
2	Free, cloud-based AI text-to-image generators (e.g., Midjourney, Bing Image Creator) are used by students for rapid furniture design aesthetic prototyping.	3.68	0.74	Agreed
3	AI-driven generative design plugins in computer-aided design (CAD) software are deployed to optimize structural timber joint geometries.	2.15	0.58	Disagreed
4	AI-powered nesting algorithms are actively utilized in workshops to automatically calculate optimal wood cutting patterns to minimize timber waste.	1.84	0.49	Disagreed
5	Computer-vision AI applications are used for the automated identification of structural timber defects (e.g., knots, rot) during workshop preparation.	1.58	0.52	Disagreed
6	Intelligent Learning Management Systems (LMS) with built-in AI grading assistants are deployed by instructors to evaluate student woodwork design portfolios.	2.08	0.61	Disagreed
7	AI-driven predictive maintenance algorithms are actively deployed to monitor and schedule servicing for heavy workshop machinery.	1.42	0.45	Disagreed
8	Intelligent tutoring systems (ITS) are utilized to provide personalized, real-time AI-guided safety prompts to students operating workshop machinery.	1.71	0.50	Disagreed

Source: *Field Survey, 2026. Scale: Mean ≥ 3.50 = High Extent/Agree; Mean < 3.50 = Low Extent/ Disagree*

Table 1 reveals a sharp divide. Respondents agreed on Items 1 and 2, which represent free, mobile-based consumer AI (Item 1: M = 3.92, SD = 0.62; Item 2: M = 3.68, SD = 0.74). Conversely, respondents disagreed on Items 3 to 8, which represent specialized workshop AI requiring stable power and institutional funding, including generative CAD (Item 3: M = 2.15), AI nesting (Item 4: M = 1.84), computer-vision defect detection (Item 5: M = 1.58), LMS grading (Item 6: M = 2.08), predictive maintenance (Item 7: M = 1.42) and ITS safety prompts (Item 8: M = 1.71). Standard deviations ranging from 0.45 to 0.74 indicate a high degree of consensus among respondents.

Research Question 2: What is the influence of AI-driven tools on students' technical skill acquisition during woodwork practices in tertiary institutions in Lagos State*?*

Table 2: Mean and Standard Deviation Responses of Respondents on the influence of AI-driven tools on students' technical skill acquisition during woodwork practices in tertiary institutions in Lagos State (N = 43)

S/N	Influence of AI-Driven Tools on Students' Skill Acquisition	M	SD	Decision
1.	Accelerates students' mastery of complex structural timber joinery designs through 3D visualization.	4.21	0.51	Agreed
2.	Minimizes material waste during practical cutting phases by optimizing layout geometry digitally.	4.14	0.62	Agreed
3.	Enhances precision and structural accuracy in furniture construction compared to traditional manual layout methods.	4.35	0.48	Agreed
4.	Provides immediate, automated feedback that allows students to correct errors during design simulation stages.	3.95	0.55	Agreed
5.	Fosters independent troubleshooting capabilities during advanced wood-processing machinery operations.	3.68	0.60	Agreed
6.	Sustained workshop skill development is heavily limited by frequent grid power failures and lack of backup generators.	4.62	0.49	Agreed
7.	High internet data costs prevent regular interaction with cloud-based AI woodwork design simulators.	4.41	0.58	Agreed
8.	Results in actual continuous, hands-on mastery of computerized numerical control (CNC) woodwork machinery in the workshop.	2.05	0.69	Disagreed
9.	Facilitates daily, equitable access to smart automated tools for all students during scheduled practical hours.	1.86	0.52	Disagreed
10.	Enhances students' physical manipulation and speed with advanced computerized tools during active industrial attachment phases.	3.51	0.70	Agreed
11.	AI supports students' ability to complete woodwork projects independently.	3.53	0.75	Agreed
12.	AI-based instruction enhances students' workshop performance.	4.57	0.82	Agreed

Source: *Field Survey, 2026. Scale: Mean ≥ 3.50 = High Extent/Agree; Mean < 3.50 = Low Extent/ Disagree*

Table 2 shows that respondents agreed on 10 out of 12 items. High agreement was recorded for cognitive and design benefits, including enhanced precision (Item 3: M = 4.35, SD

= 0.48), accelerated mastery (Item 1: M = 4.21, SD = 0.51), and minimized material waste (Item 2: M = 4.14, SD = 0.62). Respondents also agreed that infrastructural constraints limit sustained skill development, specifically power failures (Item 6: M = 4.62, SD = 0.49) and high data costs (Item 7: M = 4.41, SD = 0.58). Conversely, respondents disagreed that AI tools currently result in continuous hands-on CNC mastery (Item 8: M = 2.05, SD = 0.69) or facilitate equitable daily access to smart tools (Item 9: M = 1.86, SD = 0.52).

Research Question 3: What are the institutional and technical challenges hindering the adoption of AI-driven instructional delivery and wood workshop practices in tertiary institutions in Lagos State?

Table 3: Mean and Standard Deviation Responses of Respondents on the institutional and technical challenges hindering the adoption of AI-driven instructional delivery and wood workshop practices in tertiary institutions in Lagos State (N = 43)

S/N	Institutional and Technical Challenges Hindering	M	SD	Decision
1.	*Institutional Challenges:*	4.21	0.62	Agreed
2.	Inadequate budgetary allocation for AI software licenses.	3.86	0.74	Agreed
3.	Bureaucratic bottlenecks delaying procurement.	3.63	0.81	Agreed
4.	Resistance among senior faculty to shift to AI methods.	4.09	0.55	Agreed
5.	Curriculum lacks flexibility to incorporate AI modules.	4.35	0.49	Agreed
6.	Lack of sponsored training/certifications for educators.	3.98	0.68	Agreed
Sub	Lower priority on wood workshops vs. other engineering labs.	4.02	0.65	Agreed
7.	Institutional Cluster Average			
8.	*Technical Challenges:*	4.79	0.41	Agreed
9.	Erratic public power supply disrupting AI machinery.	4.44	0.52	Agreed
10.	Low internet bandwidth preventing cloud-based AI use.	3.88	0.70	Agreed
11.	Lack of dedicated ICT tech-support personnel in the lab.	4.12	0.66	Agreed
12.	Scarcity and high cost of smart machinery spare parts.	3.35	0.88	Disagreed
Sub	Digital skills deficits (low tech literacy) among instructors.	3.19	0.92	Disagreed

Source: *Field Survey, 2026. Scale: Mean ≥ 3.50 = High Extent/Agree; Mean < 3.50 = Low Extent/ Disagree*

The data presented in Table 3 revealed that 10 out of 12 items surpassed the 3.50 benchmark as verified challenges. The technical cluster average (M = 4.13) slightly outpaced the institutional cluster average (M = 4.02), with erratic public power supply disrupting AI machinery (Item 7: M = 4.79, SD = 0.41) identified as the most critical barrier. Conversely, two items were rejected as primary hindrances: digital skills deficits among instructors (Item 11: M = 3.35, SD = 0.88) and inadequate workshop physical infrastructure/security (Item 12: M = 3.19, SD = 0.92).

Discussion of Findings

The findings presented in Table 1 revealed a strong consensus among respondents that the current extent of AI tool integration within instructional delivery and workshop practices in tertiary institutions in Lagos State remains low and heavily constrained. While items relating to personal, low-cost tools such as mobile-based conversational AI assistants for brainstorming design concepts (e.g., ChatGPT, Copilot) and free cloud-based text-to-image generators for rapid prototyping (e.g., Bing Image Creator) showed moderate agreement, items requiring institutional infrastructure such as AI-driven generative design plugins in CAD to optimize timber joints, AI-powered nesting algorithms to minimize waste, and computer-vision applications for automated defect identification (e.g., knots, rot) recorded low extent. This confirms that integration is limited to student-owned, mobile-based workarounds. Interpreted through the TPACK framework, students develop basic Technological Knowledge (TK) on personal devices but remain structurally blocked from workshop-level application, leaving them underprepared for automated manufacturing.

This aligns with Bakare (2024), who noted that grid instability and capital deficits push institutions toward software-centric solutions. Building on this, Sanusi et al. (2022) emphasized the role of AI integration in harmonizing algorithmic tools within skill environments. Taken together, these insights underscore the urgent need for institutional investment in infrastructure and curriculum reform to bridge the gap between conceptual AI use and workshop-level mastery. Such reforms are essential to ensure that woodwork technology education remains industry-relevant and capable of preparing students for automated manufacturing environments.

The findings in Table 2 reveal a dual reality in the use of AI-driven tools within woodwork practices in Lagos State tertiary institutions. While these tools enhance technical skill acquisition, their impact is weakened by persistent infrastructural constraints. AI applications accelerate mastery of complex timber joinery through 3D visualization, reduce material waste by optimizing layout geometry, and improve precision in furniture construction compared to manual methods. They also provide automated feedback that helps students correct errors during simulations and foster independent troubleshooting when operating advanced machinery. Collectively, these benefits highlight AI's potential to bridge theory and practice in WTE. Yet, infrastructural challenges undermine these gains. Frequent power failures and the absence of backup generators disrupt workshop activities, while low internet bandwidth limits access to cloud-based simulations. Inadequate software resources confine students to restricted trial versions, and hardware deficits such as the lack of high-performance processors—prevent the use of advanced AI platforms. These systemic limitations leave students caught between the promise of AI-enhanced education and the reality of outdated workshop conditions.

This finding aligns with Oviawe and Ogbebor (2024), who emphasized technical skill acquisition as the systematic internalization of specialized psychomotor proficiencies and machinery precision in woodwork practices. It is further supported by Kagara and Ibrahim (2020), who reported that digital simulators enable rapid spatial troubleshooting and reduce layout errors before physical cutting. Overall, these findings justify the integration of AI-driven

tools as transformative pedagogical assets. Yet, without targeted investment in stable power and subsidized data, AI-driven pedagogy risks producing digitally literate graduates who remain underprepared for sustainable, industry-relevant workforce participation.

The findings in Table 3 show that 10 out of 12 items surpassed the 3.50 benchmark, confirming them as verified institutional and technical challenges hindering the adoption of AI-driven instructional delivery and wood workshop practices in Lagos State tertiary institutions. *Institutional challenges* include inadequate budgetary allocation for AI software licenses, bureaucratic bottlenecks that delay procurement, resistance among senior faculty to adopting AI methods, and rigid curricula that lack flexibility to incorporate AI modules. Other barriers are the absence of sponsored training or certifications for educators and the lower priority given to wood workshops compared to other engineering laboratories. *Technical challenges* are equally pressing. Erratic public power supply disrupts AI machinery, while low internet bandwidth prevents effective use of cloud-based applications. The lack of dedicated ICT support personnel in workshops, scarcity and high cost of smart machinery spare parts, and digital skills deficits among instructors further constrain adoption.

These findings are consistent with Babatunde and Olamide (2022), who observed that as modern wood enterprises automate, institutions constrained by technical challenges continue to train graduates on manual tools or screen-based concepts alone, leading to structural unemployment. They are further supported by Oviawe (2020), who emphasized that sustainable employability skills require a blend of advanced digital fluency, carpentry precision, and green manufacturing ideals.

Overall, the evidence justifies urgent policy intervention and targeted infrastructural funding to safeguard the practical competencies of woodwork technology graduates in Lagos State. Without such measures, the state risks producing graduates who are theoretically aware of AI-driven woodwork but remain functionally unemployable in automated green factories.

Conclusion

The findings demonstrate that while AI-driven transformation in Woodwork Technology Education holds immense potential to enhance technical skill acquisition and foster sustainable workforce development in Lagos State, its current implementation remains low and largely confined to screen-based, theoretical applications (RQ1). A critical paradox emerges: although AI tools such as cloud-based CAD simulations are recognized as vital for accelerating student mastery and boosting employability (RQ2), these benefits are undermined by systemic deficits. Chronic institutional and technical bottlenecks—most notably erratic power supply, inadequate funding for software licenses, and low internet bandwidth actively weaken digital learning pathways (RQ3).

Ultimately, transitioning WTE from manual craftsmanship into an automation-ready, high-value industrial training model depends on urgent policy intervention and targeted infrastructural investment. Without dismantling these barriers, Lagos State risks producing graduates who are theoretically literate in AI-driven woodwork but remain underprepared for the practical demands of Industry 4.0 and 5.0 workplaces.

Recommendations

Based on the empirical findings drawn from this study, the following recommendations are made:

1. Institutions in Lagos State should install dedicated solar power systems and local servers to safeguard AI-driven CAD/CAM workflows from disruptions caused by public grid failures and poor internet bandwidth.
2. Institutional administrations, in collaboration with the Lagos State Ministry of Education, should partner with global software developers to secure subsidized or open-source licenses, thereby overcoming budgetary constraints and ensuring equitable access to AI tools.
3. The National Board for Technical Education (NBTE) should update the curriculum to balance screen-based AI simulations with hands-on machinery practice. In addition, specialized ICT technicians should be stationed directly in workshops to provide real-time technical support and ensure smooth integration of AI-driven tools.

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