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INFLUENCE OF DIGITAL TOOLS ON ADVANCING WOODWORK TECHNOLOGY EDUCATION FOR ECONOMIC SUSTAINABILITY IN OGUN STATE

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Abstract

This study examined the influence of digital tools on the advancement of woodwork technology education and their contribution to economic sustainability in Ogun State, Nigeria. The integration of digital tools such as Computer-Aided Design (CAD), Computer Numerical Control (CNC) machines, and Virtual Reality (VR) simulators had transformed teaching and learning processes in vocational education globally. However, their adoption in Ogun State remained inconsistent, limiting their potential for educational and economic transformation. The study adopted a descriptive survey design and employed stratified random sampling to select a sample of 384 participants, comprising woodwork educators, final-year students, and industry practitioners. Data were collected using a structured questionnaire and analyzed using descriptive statistics and the Chi-square test of independence at a 0.05 level of significance. Findings revealed a statistically significant relationship between the availability and effective utilization of digital tools and the quality of woodwork technology education. Results also indicated that digital tools had a positive impact on students' learning outcomes, practical skill acquisition, and graduate employability. Furthermore, integration of digital tools was found to significantly contribute to income generation and economic sustainability, based on the findings it was recommended that institutions be equipped with modern digital tools, educators be trained in digital pedagogy, and curricula be revised to reflect current industry demands.

Keywords: Digital tools, woodwork technology, vocational education, skill acquisition

Introduction

The integration of digital tools into education has become a pivotal strategy for enhancing teaching and learning processes globally. In technical and vocational education, particularly in woodwork technology, digital tools have revolutionized traditional practices, enabling educators and learners to adopt modern techniques that align with industry standards. These tools, including Computer-Aided Design (CAD), Computer Numerical Control (CNC) machines, and Virtual Reality (VR) simulators, not only enhance precision and efficiency but also foster creativity and innovation in the learning process (United Nations Educational, Scientific and Cultural Organization,2022). In Nigeria, the Federal Ministry of Education has emphasized the role of vocational and technical education in addressing unemployment and achieving economic sustainability. Ogun State, known for its prominence in technical education, is uniquely positioned to lead in integrating digital tools into woodwork technology education. However, despite global advancements, the adoption of digital tools in the region remains inconsistent, limiting the potential for educational and economic transformation. Research indicates that many institutions in Nigeria face challenges such as inadequate funding, lack of infrastructure, and limited technical expertise, which impede the effective use of digital tools (Aina & Ayodele, 2022).

Globally, the adoption of digital tools in technical education has shown significant promise. For instance, in developed countries, these tools have been linked to increased student engagement, improved learning outcomes, and enhanced workforce readiness (World Bank, 2021). For Ogun State, leveraging digital tools in woodwork education can bridge the gap between traditional practices and modern industry demands, equipping students with the skills needed to excel in the global economy. Moreover, the role of woodwork technology in promoting entrepreneurship and industrial development underscores its importance in fostering economic resilience and sustainability (Yusuf & Alabi, 2019). The influence of digital tools on advancing woodwork technology education is an area of critical importance for Ogun State. This study seeks to explore how these tools can be effectively utilized to enhance skill acquisition, improve teaching methodologies, and contribute to the state's economic sustainability through job creation and innovation. By addressing these issues, the research aims to contribute to the broader discourse on aligning technical education with the demands of a digital economy.

Statement of the Problem

The evolution of technology has significantly transformed vocational and technical education worldwide, yet many institutions in Nigeria, including those in Ogun State, continue to grapple with outdated teaching methods. In woodwork technology education, traditional approaches that rely on manual tools and methods dominate instructional practices, leaving students inadequately prepared for the demands of the modern woodwork industry. This disconnect has contributed to a persistent skills gap, limiting students' employability, entrepreneurial potential, and ability to compete in the global economy. Moreover, the economic potential of woodwork technology education remains underutilized in Ogun State. The inability to adopt digital tools limits opportunities for entrepreneurship, product innovation, and market competitiveness. For instance, in regions where digital tools have been integrated into vocational training, there has been a notable increase in employment outcomes, income generation, and small-scale industrial growth. In contrast, Ogun State continues to struggle with high unemployment rates among technical education graduates, partly due to their reliance on obsolete skills that are no longer relevant in today's economy. Another critical issue is the lack of alignment between educational curricula and industry requirements. While industries increasingly demand technologically proficient workers, most woodwork technology programs in Ogun State have not updated their curricula to reflect these changes. This misalignment not only reduces the employability of graduates but also impedes the state's broader goals for economic sustainability and industrial growth. Addressing these challenges requires a comprehensive examination of how digital tools influence woodwork technology education and its impact on economic sustainability. Through identifying gaps and opportunities, this research aims to provide actionable solutions that align educational practices with industry needs, ultimately fostering skill acquisition, innovation, and economic resilience in Ogun State.

Purpose of the Study

This study examined the influence of digital tools on advancing woodwork technology education in Ogun State and to explore their contribution to economic sustainability. Specifically, the study sought to:

1. Assess the availability and effectiveness of digital tools in woodwork technology education.
2. Investigate how digital tools enhance student performance and skill acquisition.

3. Evaluate the economic outcomes linked to integrating digital tools in woodwork education, including employment opportunities and income generation.

Research Questions

The following research questions were raised to guide this paper;

1. To what extent are digital tools available and effectively utilized in woodwork technology education programs in Ogun State?
2. How do digital tools impact students' learning outcomes and practical skill development in woodwork technology education?
3. What is the contribution of digital tool integration in woodwork technology education to graduate employability and income generation in Ogun State?

Research Hypotheses

The following hypotheses were raised in null form to guide this paper;

H_{01}: There is no significant relationship between the availability and effective utilization of digital tools and the quality of woodwork technology education programs in Ogun State.

H_{02}: The use of digital tools does not significantly affect students' learning outcomes and practical skill acquisition in woodwork technology education.

H_{03}: The integration of digital tools in woodwork technology education does not significantly contribute to graduate employability and income generation in Ogun State.

Methods

This research used a descriptive survey approach to investigate the impact of digital tools on the enhancement of woodwork technology education and economic sustainability in Ogun State. The descriptive survey methodology is suitable as it facilitates data gathering from a wide population to discern correlations, trends, and the influence of digital tools on the dependent variables (Creswell, 2018). This approach is especially appropriate for examining perspectives, experiences, and results associated with the incorporation of digital resources in educational environments. The population of this study consisted of individuals actively involved in woodwork technology education and its application within Ogun State. This includes educators who teach woodwork technology courses across universities, colleges of education, and technical schools in the state. Additionally, the study targets final-year students enrolled in woodwork technology programs, as they possess substantial exposure to both theoretical instruction and practical training. Their perspectives are vital in assessing the effectiveness of digital tools in enhancing learning outcomes and skill development. The population also included industry professionals and stakeholders in the woodwork sector who maintain collaborations with educational institutions, provide industrial attachments, or recruit graduates from these programs. Given that the exact number of individuals in the target population is not officially documented, the study adopted the Cochran's formula for determining sample size in an infinite population scenario. The formula is given as:

$$n_o = \frac{Z^2 \cdot \mathbf{p} \cdot (\mathbf{1}-\mathbf{p})}{e^2}$$

where;

n_0 is the sample size needed.

Z is the Z-value corresponding to the desired confidence level.

p is the estimated proportion of the population that exhibits the characteristic of interest.

e is the margin of error.

substituting the values;

Z = 1.96 (for 95% confidence level)
p = 0.5 (estimated proportion)
e = 0.05 (5% margin of error)
therefore;

$$n_o = \frac{1.96^2 \cdot \mathbf{0.5} \cdot (\mathbf{1} - \mathbf{0.5})}{0.05^2}$$

$$= \frac{3.84 \text{ x } \mathbf{0.5} \text{ x } (\mathbf{0.5})}{0.0025}$$

$$= \frac{0.96}{0.0025}$$

$$= 384$$

The study employed a stratified random sampling technique to ensure balanced representation from the key groups involved in woodwork technology education and practice in Ogun State. This method allowed for the division of the population into distinct strata based on their roles in the educational and industrial landscape. The first group comprised educators teaching woodwork technology in public and private institutions, including universities, colleges of education, and technical schools. These individuals are directly responsible for curriculum delivery and the adoption of digital instructional tools. The second group are final-year students enrolled in woodwork technology programs across vocational and technical institutions. As learners at the advanced stage of their training, they provide critical insights into how digital tools influence learning outcomes and skill acquisition. The third group consists of industry practitioners engaged in furniture production, carpentry, and related woodwork enterprises. The primary instrument used for data collection in this study was a structured questionnaire designed to gather information on the availability and use of digital tools, their influence on student performance and skill acquisition, and their impact on economic outcomes such as employment and income generation. The questionnaire comprised two sections: the first captured demographic details of respondents, including age, gender, role, and institutional affiliation, while the second contained Likert-scale items addressing the key research variables. Responses were measured on a five-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1), allowing for the assessment of perceptions and attitudes toward digital integration in woodwork education. The instrument was reviewed by experts in technical education for validity and piloted among a small group to ensure clarity and reliability before final administration. The primary instrument used for data collection was a structured questionnaire designed to measure the metrics associated with the independent and dependent variables. The questionnaires contain four sections:

In line with the recommendations of Creswell and Guetterman (2021), the validity of the instrument was ensured through expert review. The questionnaire underwent both content and face validity checks by a panel of three experts in vocational education and research methodology. These experts assessed the instrument for clarity, alignment with the research objectives, and overall comprehensiveness. Based on their feedback, necessary revisions were made to improve the precision and relevance of the questionnaire before it was finalized for data collection. To establish the reliability of the instrument, a pilot study was conducted involving 30 respondents comprising 10 educators, 10 students, and 10 industry practitioners who were not part of the main study population. The internal

consistency of the questionnaire was evaluated using the Cronbach's Alpha method. The overall reliability coefficient obtained exceeded the acceptable threshold of 0.70, indicating that the instrument was sufficiently reliable for the main study. Items with weak correlation were revised or eliminated to enhance measurement consistency. Data collection was carried out using the finalized structured questionnaire, administered through both physical and electronic means. Hard copies were distributed to respondents in selected institutions and organizations within accessible locations, while digital versions were shared via email and online survey platforms to reach participants in remote or less accessible areas. The data collection period spanned four weeks, during which follow-up communications were made to encourage participation and improve response rates.

Quantitative data collected through the structured questionnaire were analyzed using both descriptive and inferential statistical methods. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize demographic information and respondents' perceptions of digital tool availability, usage, and impact. To test the null hypotheses and examine the association between the integration of digital tools and key outcomes such as the quality of woodwork education, student skill acquisition, and graduate employability, the Chi-square test of independence was employed. This test was used to determine whether significant associations exist between categorical groupings of respondents' perceptions and the identified outcome variables. All statistical analyses were carried out using the Statistical Package for the Social Sciences (SPSS) version 26, with a significance level set at 0.05.

Result

Table 4.1 Demographic Representation

Gender	**Number of Respondents**	**Percentage**
Female	198	52.1
Male	182	47.9
Total	**380**	**100.0**
18 - 25	148	38.9
26 - 30	140	36.8
31 - 40	48	12.6
41 and Above	44	11.6
Total	**380**	**100.0**

Source: Field Survey, (2025)

The demographic distribution of the respondents reveals a relatively balanced gender split, with females slightly outnumbering males at 52.1% and 47.9%, respectively. The majority of respondents fall within the younger age brackets, with 38.9% aged between 18–25 and 36.8% between 26–30, indicating a predominantly youthful user base. Older age groups are less represented, with only 12.6% aged 31–40 and 11.6% aged 41 and above.

Table 4.2: What is the availability and effectiveness of digital tools in woodwork technology education in Ogun State?

	Item	**SA**	**A**	**N**	**D**	**SD**	**Mean**	**Decision**
1	My institution/organization has access to digital tools such as	30 (7.9%)	29 (7.6%)	236 (62.1%)	38 (10.0%)	47 (12.4%)	2.89	Low

	CAD, CNC, or VR for woodwork education.							
2	Digital tools are regularly used in teaching or training woodwork technology.	43 (11.3%)	33 (8.7%)	231 (60.8%)	43 (11.3%)	30 (7.9%)	3.04	Moderate
3	The existing digital tools are sufficient to meet instructional and training needs.	34 (8.9%)	32 (8.4%)	241 (63.4%)	40 (10.5%)	33 (8.7%)	2.98	Low
4	The integration of digital tools has enhanced the delivery of woodwork lessons.	33 (8.7%)	40 (10.5%)	229 (60.3%)	33 (8.7%)	45 (11.8%)	2.96	Low
5	Adequate technical support is available for using digital tools in woodwork education.	40 (10.5%)	36 (9.5%)	230 (60.5%)	42 (11.1%)	32 (8.4%)	3.03	Moderate
5	**Overall Mean**	**180 (9.5%)**	**170 (8.9%)**	**1167 (61.4%)**	**196 (10.3%)**	**187 (9.9%)**	**2.98**	**Low**

Source: Field Survey, (2025).

Response from the table shows that 9.5% of the respondents strongly agreed that digital tools are available and effective in woodwork technology education in Ogun State, while 8.9% agreed. A significant majority of 61.4% remained neutral on the issue. Additionally, 10.3% disagreed and 9.9% strongly disagreed. The overall mean score of 2.98 indicates that the availability and effectiveness of digital tools in woodwork technology education in Ogun State is rated to a low extent.

Table 4.3: How do digital tools impact student learning outcomes and skill acquisition?

Item	SA	A	N	D	SD	Mean	Decision
Digital tools help improve the precision and quality of woodwork projects.	207 (54.5%)	114 (30.0%)	20 (5.3%)	20 (5.3%)	19 (5.0%)	4.24	High
Students demonstrate improved creativity and innovation through digital tool usage.	209 (55.0%)	119 (31.3%)	15 (3.9%)	16 (4.2%)	21 (5.5%)	4.26	High
Digital tools have enhanced my	20 (5.3%)	203 (53.4%)	122 (32.1%)	16 (4.2%)	19 (5.0%)	3.50	High

understanding or teaching of woodwork concepts.							
Students acquire practical skills that are relevant to modern industry demands.	114 (30.0%)	201 (52.9%)	31 (8.2%)	18 (4.7%)	16 (4.2%)	4.00	High
Digital instruction leads to better engagement and academic performance in woodwork classes.	136 (35.8%)	131 (34.5%)	30 (7.9%)	42 (11.1%)	41 (10.8%)	3.73	High
Overall Mean	**686 (36.1%)**	**768 (40.4%)**	**218 (11.5%)**	**112 (5.9%)**	**116 (6.1%)**	**3.95**	**High**

Source: Field Survey, (2025).

Response from the table shows that 36.1% of the respondents strongly agreed that digital tools impact student learning outcomes and skill acquisition, while 40.4% agreed. Additionally, 11.5% of the respondents were neutral, 5.9% disagreed, and 6.1% strongly disagreed. The overall mean score of 3.95 indicates that digital tools have a high impact on student learning outcomes and skill acquisition in woodwork technology education.

Table 4.4: How does digital tool integration in woodwork technology education contribute to economic sustainability?

Item	SA	A	N	D	SD	Mean	Decision
Exposure to digital tools improves students' chances of employment after graduation.	206 (54.2%)	123 (32.4%)	14 (3.7%)	18 (4.7%)	19 (5.0%)	4.26	High
The use of digital tools helps graduates to start or scale their woodwork businesses.	204 (53.7%)	121 (31.8%)	24 (6.3%)	15 (3.9%)	16 (4.2%)	4.27	High
Employers prefer hiring candidates with experience using digital woodwork tools.	237 (62.4%)	31 (8.2%)	38 (10.0%)	37 (9.7%)	37 (9.7%)	4.04	High
Integrating digital tools in training boosts productivity and innovation in the woodwork sector.	304 (80.0%)	22 (5.8%)	17 (4.5%)	20 (5.3%)	17 (4.5%)	4.52	High
Digital skills acquired from woodwork	137 (36.1%)	136 (35.8%)	50 (13.2%	26 (6.8%)	31 (8.2%)	3.85	High

training have increased my/others' income-generating ability.			)			
	1088 (57.3%)	**433 (22.8%)**	**143 (7.5%)**	**116 (6.1%)**	**120 (6.3%)**	
Overall Mean					**4.19**	**High**

Source: Field Survey, (2025).

Response from the table shows that 57.3% of the respondents strongly agreed that digital tool integration in woodwork technology education contributes to economic sustainability, while 22.8% agreed. Additionally, 7.5% of the respondents were neutral, 6.1% disagreed, and 6.3% strongly disagreed. The overall mean score of 4.19 indicates that the contribution of digital tool integration to economic sustainability is rated high in woodwork technology education.

Hypothesis

The study employed the Chi-square (χ^2) test of independence to examine the association between digital tool integration and key variables such as quality of woodwork technology education, student learning outcomes, and economic sustainability. The hypotheses were tested using p-values derived from the Chi-square output. Where the p-value is greater than or equal to 0.05, the null hypothesis (H_0) is not rejected, indicating no statistically significant association. However, where the p-value is less than 0.05, the null hypothesis (H_0) is rejected, indicating a statistically significant association between the variables.

Hypotheses I: There is no significant relationship between the availability and effective utilization of digital tools and the quality of woodwork technology education programs in Ogun State.

Test Statistics

	AEQW
Chi-Square	37.120[a]
df	7
Asymp. Sig.	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 12.5.

The Chi-square test results reveal a statistically significant relationship between the availability and effective utilization of digital tools and the quality of woodwork technology education programs in Ogun State ($\chi^2 = 37.120$, df = 7, $p < 0.001$). This indicates that differences in digital tool availability and usage are significantly associated with variations in the perceived quality of woodwork education programs. Given that the p-value is less than the significance level of 0.05, the null hypothesis is rejected. Therefore, it can be concluded that the availability and effective utilization of digital tools significantly influence the quality of woodwork technology education in Ogun State.

Hypotheses II: The use of digital tools does not significantly affect students' learning outcomes and practical skill acquisition in woodwork technology education.

Test Statistics

	DTSLO
Chi-Square	41.013[a]
Df	9
Asymp. Sig.	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 12.5.

The Chi-square test results reveal a statistically significant relationship between the use of digital tools and students' learning outcomes and practical skill acquisition in woodwork technology education ($\chi^2 = 41.013$, df = 9, $p < 0.001$). This indicates that variations in the use of digital tools are significantly associated with differences in student learning outcomes and skill development. Since the p-value is less than the 0.05 significance level, the null hypothesis is rejected. Therefore, it can be concluded that the use of digital tools has a significant effect on students' learning outcomes and practical skill acquisition in woodwork technology education.

Hypotheses III: The integration of digital tools in woodwork technology education does not significantly contribute to graduate employability and income generation in Ogun State.

Test Statistics

	IDTGEI
Chi-Square	35.215[a]
Df	11
Asymp. Sig.	.001

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 12.5.

The Chi-square test results reveal a statistically significant relationship between the integration of digital tools in woodwork technology education and graduate employability and income generation in Ogun State ($\chi^2 = 35.215$, df = 11, $p = 0.001$). This suggests that variations in digital tool integration are significantly associated with differences in employment opportunities and income outcomes for graduates. Since the p-value is less than the 0.05 significance level, the null hypothesis is rejected. Therefore, it can be concluded that the integration of digital tools in woodwork technology education significantly contributes to graduate employability and income generation in Ogun State.

Discussion

The findings of this study revealed a significant relationship between the availability and effective utilization of digital tools and the quality of woodwork technology education, as well as their impact on students' learning outcomes and economic sustainability in Ogun State. These results are consistent with multiple recent studies. Isak, Babak, and Hren (2023) investigated the use of digital tools such as virtual reality, cloud platforms, and

interactive apps in vocational education. They found that digital tools improved educational quality and student skill development by making lessons more interactive, accessible, and aligned with market needs (Isak et al., 2023). This supports this study's finding that digital tools significantly influence students' practical skill acquisition and enhance the quality of woodwork technology education. Similarly, Zhao and Suqin (2024) examined how AI and VR were integrated into vocational education as part of curriculum reform. Their study showed these tools improved student engagement and outcomes and provided industry-aligned training simulations (Zhao & Suqin, 2024). This aligns with our results showing that digital tool usage is associated with better student performance and practical outcomes in woodwork education. Wahab et al. (2025) focused specifically on woodwork technology and vocational skills in Nigeria, finding that inadequate access to tools and training opportunities limited youth employability. They recommended government and private support for tool acquisition and modern training methods to tackle unemployment (Wahab et al., 2025). This study not only confirms this issue but provides empirical evidence that digital tools significantly contribute to income generation and employability in Ogun State.

Furthermore, Taranova et al. (2021) emphasized the need to develop students' digital competencies to ensure economic sustainability. Their work supports the view that digital education reforms can strengthen workforce readiness and promote sustainable development through enhanced employability (Taranova et al., 2021). Lastly, Blishchuk and Domsha (2021) emphasized that digital tools are not just educational aids but also levers for sustainable societal and economic development. Their study highlighted how digitalization fosters resource efficiency, job creation, and long-term economic growth when embedded into education systems (Blishchuk & Domsha, 2021), which echoes the findings on economic sustainability through digital integration.

Conclusion

This study investigated the influence of digital tools on advancing woodwork technology education and their contribution to economic sustainability in Ogun State. The findings revealed a statistically significant relationship between the availability and effective utilization of digital tools and the quality of woodwork technology education programs. Additionally, digital tools were found to have a strong positive impact on students' learning outcomes, skill acquisition, and graduate employability. These results align with recent studies which confirm that digital integration enhances vocational education quality and contributes meaningfully to economic development by improving productivity, entrepreneurship, and income generation. It is therefore evident that digital tools are not merely supplementary teaching aids but essential instruments for transforming woodwork education and building a digitally competent workforce for the 21st-century economy.

Recommendations

Based on the findings of this study, the following were recommended;

1. Educational institutions offering woodwork technology should be supported with modern digital tools such as CAD software, CNC machines, and VR simulations. This will improve both teaching quality and hands-on training.
2. Regular professional development programs should be organized to equip woodwork educators with the necessary digital skills to effectively integrate technology into their instructional practices.

3.The curriculum should be updated to include digital tool competency as a core component of woodwork technology education, ensuring alignment with modern industry requirements.

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