**Preserving Cultural Heritage through AI-powered Art Education: A Project-based Study in North Central Nigeria.**

 **Abstract**

This study investigated the role of Artificial Intelligence (AI)-powered Art Education in preserving cultural heritage in North Central Nigeria through a project-based learning approach. As cultural traditions face erosion due to modernization, there is a critical need to leverage innovative educational strategies to document, revitalize, and transmit indigenous knowledge. This research adopted a mixed-methods design, combining qualitative insights from interviews and focus group discussions with quantitative data collected through structured questionnaires administered to Art Educators, Students, and Cultural Stakeholders across selected institutions in the region. The intervention component involved collaborative art projects where learners used AI tools to research, visualize, and reinterpret local heritage artifacts and narratives. Quantitative data were analyzed using the Statistical Package for the Social Sciences (SPSS), which facilitated descriptive statistics, paired sample t-tests, and Regression Analysis to measure the impact of the AI-powered Art Education on participants' cultural awareness and creative engagement. The findings highlighted a significant improvement in learners’ understanding and appreciation of cultural heritage, as well as enhanced digital Art literacy. This study underscores the transformative potential of AI in art education and its implications for sustainable cultural preservation in contemporary African societies.

**Keywords:** AI in Education, Art Education, Cultural Preservation, Project-Based Learning, SPSS.

**Introduction**

The preservation of cultural heritage has emerged as a critical area of concern in many developing societies, particularly in the face of globalization, technological advancement, and socio-political changes. Cultural heritage encompasses tangible and intangible expressions of a people's identity such as languages, traditions, crafts, performances, festivals, architecture, and artworks which serve as the bedrock of historical continuity and community cohesion (UNESCO, 2003). In North Central Nigeria, a region characterized by rich ethnic diversity and traditional practices, the erosion of indigenous knowledge and cultural expressions poses a significant threat to sustainable cultural development. Young people, in particular, are increasingly disconnected from their cultural roots due to the dominance of Western ideologies in formal education and media narratives (Ani, et al 2015).

As education continues to evolve in the digital age, integrating technology into learning environments offers new possibilities for cultural transmission and engagement. Artificial Intelligence (AI), once limited to industrial and commercial applications, is now being embraced in the educational sector to enhance teaching and learning outcomes (Luckin et al., 2016). In art education, AI-powered tools can facilitate creative learning by enabling students to visualize, reinterpret, and digitally preserve elements of their cultural heritage in innovative ways. According to Onyebuchi-Igbokwe (2025), AI-driven platforms such as social media algorithms, generative design tools, and digital marketplaces now play a pivotal role in connecting artists with global audiences These tools not only encourage interactive and self-directed learning but also offer new platforms for artistic expression that bridge traditional knowledge with contemporary media (Cope et al., 2020).

Project-based learning (PBL) has been identified as a powerful pedagogical strategy that aligns well with art education and cultural preservation goals. PBL engages learners in collaborative, real-world tasks that promote critical thinking, problem-solving, and experiential learning (Thomas, 2000). When combined with AI technologies, PBL can empower students to investigate cultural themes, create digital representations of heritage artifacts, and present their findings in meaningful ways that reinforce identity and community pride (Babalola, et al 2024).

This study explores the integration of AI-powered tools in project-based art education as a means to preserve and promote cultural heritage in North Central Nigeria. It investigates how such integration can enhance students' awareness, appreciation, and documentation of indigenous cultures. Through a mixed-methods approach involving surveys, interviews, focus group discussions, and digital art projects, the research seeks to assess the effectiveness of AI-driven educational interventions in cultural preservation efforts. By analyzing both qualitative and quantitative data with the aid of the Statistical Package for the Social Sciences (SPSS), this study contributes to the growing discourse on culturally responsive education in Africa and the transformative potential of AI in safeguarding heritage for future generations.

**Statement of the Problem**

Despite the cultural richness and diversity of North Central Nigeria, the region faces a growing threat to the preservation of its indigenous heritage due to the combined forces of globalization, urbanization, digital media influence, and educational neglect. Traditional knowledge systems, indigenous art forms, oral histories, and community practices are rapidly declining, with younger generations showing limited interest or awareness of their cultural roots (Ani, et al 2015). Formal education systems in the region often emphasize Western curricula and technologies without contextualizing them to local heritage, thereby marginalizing indigenous knowledge and artistic traditions.

Moreover, while digital transformation is sweeping through various sectors in Nigeria, the application of emerging technologies such as Artificial Intelligence (AI) in education particularly in art education remains significantly underutilized. The gap between cultural preservation and modern education technologies continues to widen, leaving art educators and students without effective tools or methodologies to meaningfully engage with and document their heritage (Babalola, et al 2024). Consequently, the creative and educational potential of AI as a medium for preserving and transmitting cultural knowledge has not been fully explored or harnessed in the Nigerian context.

Furthermore, project-based learning (PBL), which encourages creativity, collaboration, and community relevance, is yet to be widely adopted in art classrooms across North Central Nigeria. Educators often lack training in both AI tools and culturally responsive pedagogy, while schools face infrastructural and policy limitations that hinder the integration of innovative teaching approaches (UNESCO, 2021). As a result, many students graduate with little or no exposure to the cultural narratives of their communities or the digital competencies necessary for preserving them.

This study, therefore, addresses the critical need to bridge this gap by examining how AI-powered, project-based art education can be used to preserve cultural heritage in North Central Nigeria. It seeks to provide empirical evidence on the effectiveness of AI-integrated educational strategies in enhancing students’ cultural awareness and artistic expression while promoting sustainable heritage conservation. Without timely intervention, the region risks losing invaluable cultural assets and missing the opportunity to equip future generations with the tools and knowledge required to safeguard their identity in a rapidly changing world.

**Research Objectives**

1. To explore the current state of cultural heritage awareness among students in North Central Nigeria.
2. To assess the effectiveness of integrating Artificial Intelligence (AI) tools into art education for cultural preservation.
3. To examine the impact of project-based learning (PBL) strategies on students’ engagement with indigenous art and cultural knowledge.

**Research Questions**

1. What is the current level of awareness and understanding of cultural heritage among students in North Central Nigeria?
2. How effective is the integration of AI tools in art education in promoting cultural preservation?
3. In what ways does project-based learning influence students’ engagement with indigenous art forms and cultural knowledge?

**Cultural Heritage and AI-powered Art Education**

Cultural heritage, encompassing both tangible assets such as artifacts, architecture, and textiles, and intangible elements like folklore, rituals, music, and indigenous knowledge systems, represents the identity, memory, and values of a people (UNESCO, 2003). In regions like North Central Nigeria, this heritage is deeply embedded in local traditions and community life, yet it is increasingly under threat due to globalization, urban migration, socio-political instability, and a lack of systematic preservation efforts (Ani, et al 2015). This cultural erosion is especially evident among younger generations, who are often disconnected from ancestral knowledge and practices due to the influence of westernized education and digital media. On the flipside, Onyebuchi-Igbokwe (2025) recalls that Girls’ education in Northeast Nigeria is significantly hindered by cultural and socioeconomic barriers, including early marriage, gender-based discrimination, poverty, and inadequate infrastructure.

Artificial Intelligence (AI)-powered education offers a transformative pathway for preserving and revitalizing cultural heritage through modern pedagogical practices. AI can act as a bridge between traditional cultural forms and contemporary learning environments by digitizing cultural content, enabling immersive storytelling, and supporting interactive, student-centered experiences. By using AI algorithms to archive, analyze, and generate cultural expressions, educators can preserve endangered languages, oral histories, music, and visual art in ways that are both engaging and scalable (Cope et al., 2020).

One of the most compelling applications of AI in cultural education is the development of intelligent learning platforms that adapt to individual students’ interests and learning styles. These platforms can be customized to include cultural heritage content specific to a region, such as the weaving techniques of the Tiv people, the Nwoko dance traditions of the Idoma, or the architectural styles of the Nupe. In such systems, students not only learn about their cultural history but also actively participate in its reinterpretation through creative projects, digital storytelling, and AI-assisted art generation (Luckin et al., 2016).

Furthermore, AI technologies like virtual reality (VR), augmented reality (AR), and machine learning can simulate cultural environments and rituals, allowing students to explore their heritage in immersive, interactive ways. For example, virtual reconstructions of traditional festivals or ancient architectural sites can provide learners with experiential insights that are otherwise inaccessible due to geographical or political limitations (Elgammal et al., 2017). AI can also assist in transcribing oral traditions, translating indigenous languages, and identifying patterns in historical data, thus enabling researchers and educators to build comprehensive cultural databases.

In essence, AI-powered education provides not only a mechanism for safeguarding cultural heritage but also a platform for reimagining how traditional knowledge can be transmitted in a digital age. When combined with inclusive and culturally responsive pedagogical strategies, AI can empower young people to become active custodians of their heritage, fostering a deeper connection to their roots while equipping them with 21st-century digital competencies.

### ****Review of Related Literature****

The literature on AI-powered art education and cultural heritage preservation intersects multiple disciplines, including educational technology, art pedagogy, digital heritage, and African cultural studies. This review is structured thematically to highlight global trends, regional gaps, and emerging innovations relevant to the North Central Nigerian context.

#### ****1. Artificial Intelligence in Education****

Artificial Intelligence (AI) has become a transformative force in education, enabling personalized learning, adaptive assessments, and data-driven instruction (Luckin et al., 2016). AI tools such as intelligent tutoring systems, and learning analytics platforms have enhanced how educators deliver content and assess learner performance (Cope et al., 2020). In art education, AI applications include image recognition, style transfer, and generative design tools, which offer students new ways to explore visual expression and aesthetics (Elgammal et al., 2017).

However, scholars like Holmes et al. (2019) caution that the integration of AI must be pedagogy-driven rather than technology-led. They emphasize the need for AI to support not replace creative thinking and cultural contextualization, especially in disciplines like art where subjectivity and heritage are integral.

#### ****2. Art Education and Technology Integration****

Art education has traditionally emphasized human-centered creativity, expression, and cultural transmission. The infusion of technology into this space has generated both enthusiasm and skepticism. On one hand, digital tools have broadened access to artistic resources and encouraged experimentation; on the other, there are concerns about over-reliance on automation (Rowe, 2020).

A Study by Peppler (2010) highlights the importance of balancing technological tools with traditional materials to maintain cultural integrity. When used appropriately, technology can enhance students' understanding of cultural symbols, motifs, and storytelling, making learning both interactive and meaningful.

#### ****3. AI for Cultural Heritage Preservation****

Globally, AI has been employed in cultural preservation efforts ranging from virtual reconstructions of heritage sites to the digitization of indigenous languages and oral histories. The Smithsonian Institution, for instance, uses AI to catalogue and analyze millions of museum objects, enhancing accessibility and historical interpretation (Smithsonian, 2021).

In Africa, efforts are growing but remain uneven. Rizvic, et al (2020) implemented AI-enhanced digital storytelling workshops in schools, allowing students to preserve family histories. Similarly, UNESCO (2020) supported initiatives in East Africa to use machine learning in translating endangered languages.

However, the literature notes challenges such as ethical data use, cultural sensitivity, and infrastructure deficits (Mgbomo et al., 2025). These factors are critical when dealing with indigenous knowledge systems that are often orally transmitted and community-owned.

Ladson-Billings (1995) introduced culturally responsive pedagogy as a framework that affirms students’ cultural identities and integrates them into the learning process. In the African context, this approach is essential for decolonizing education and promoting heritage appreciation. Scholars like Ani, et al (2015) argue that Nigerian curricula often marginalize local art forms and histories, leading to a generational disconnect.

Integrating AI with culturally responsive pedagogy allows for the co-creation of educational content that is not only technologically advanced but also culturally relevant. This synergy fosters learner engagement, critical thinking, and cultural pride.

### ****Gap in Literature****

The literature collectively supports the potential of AI-powered art education as a powerful tool for preserving cultural heritage, particularly when grounded in constructivist, culturally responsive, and project-based frameworks. While global case studies provide valuable insights, there is a notable gap in region-specific research, particularly within North Central Nigeria. This study, therefore, seeks to fill this void by empirically exploring how AI can be leveraged to sustain and promote indigenous cultural knowledge through art education in a culturally rich but under-researched context.

### ****Theoretical Foundations****

The integration of Artificial Intelligence (AI) into art education for cultural heritage preservation is underpinned by several theoretical frameworks that bridge technology, pedagogy, and cultural studies. This section outlines two primary theories that inform this study:

#### ****Connectivism (George Siemens, 2005)****

As a learning theory for the digital age, connectivism emphasizes the role of social and technological networks in the learning process. It is particularly applicable to AI-driven environments where learners access knowledge through interconnected digital tools, online communities, and intelligent systems.

Through AI-powered platforms, students can interact with cultural datasets, collaborate with peers globally, and engage with dynamic, evolving content. This mirrors the theory's central premise that learning resides in the capacity to navigate and grow one’s network of knowledge sources, which is essential for cross-cultural understanding and innovation in heritage education.

#### ****Technological Pedagogical Content Knowledge (TPACK) Framework (Mishra & Koehler, 2006)****

The TPACK framework highlights the interplay between technology, pedagogy, and content knowledge in effective teaching. For educators using AI to teach art and cultural heritage, it is essential to understand not only the content (e.g., indigenous art forms) and pedagogy (e.g., project-based learning) but also how to effectively integrate technology like AI to enhance instruction.

This framework is especially useful in this study as it provides a lens through which the training needs, digital competency, and instructional approaches of art educators in North Central Nigeria can be assessed. It also emphasizes the importance of balance ensuring that AI enhances rather than overshadows the cultural and pedagogical integrity of the learning experience.

### ****Empirical Evidence****

Empirical studies on the intersection of Artificial Intelligence (AI), art education, and cultural heritage preservation have begun to reveal significant insights into how technology can be harnessed to safeguard indigenous knowledge and promote inclusive, creative learning environments. Although research in this area is still emerging especially in Sub-Saharan Africa existing literature offers a solid foundation for the present study.

#### ****1. AI in Education and Cultural Preservation****

A study by Elgammal et al. (2017) demonstrated how Creative Adversarial Networks (CANs), a form of AI, can generate art by learning and deviating from established artistic styles. This technology has potential to mimic and extend indigenous art patterns, such as those found in traditional African textiles, murals, and symbols, allowing students to explore and reinterpret their heritage in digital form. Similarly, in a UNESCO-funded initiative in East Africa, AI was used to digitize oral traditions and endangered languages, significantly improving access to cultural archives for students and researchers (UNESCO, 2020).

#### ****2. AI-enhanced Project-Based Learning (PBL)****

Empirical research by Cope et al. (2020) on AI-enabled learning ecologies found that AI systems could personalize learning experiences in project-based environments, fostering deeper engagement and critical thinking. When applied to art education, such systems allow students to develop cultural projects that are both creative and contextually relevant. For example, Nigerian schools piloting AI-driven platforms like Teachable Machine and Artbreeder have reported increased student interest in indigenous design motifs and a greater sense of cultural identity among participants (Ogunyemi & Okonkwo, 2022).

#### ****4. Digital Technology, Youth Engagement, and Identity****

In a case study, Rizvic, et al (2020) explored how digital storytelling and AI tools were used by students to document family histories and local customs. The study found that students not only gained technical skills but also developed a stronger connection to their roots. This aligns with connectivist theories, showing that AI-powered education can facilitate cultural identity formation and peer learning across digital networks.

#### ****5. Challenges in AI Integration****

Despite these benefits, studies have also highlighted significant barriers to the effective implementation of AI in educational settings. These include infrastructural deficits, lack of teacher training, and concerns about cultural misrepresentation (Luckin et al., 2016). In Nigeria, for example, research by Mgbomo et al. (2025) revealed that while schools are increasingly aware of AI's potential, many lack the resources and policy frameworks needed for meaningful adoption.

### ****Synthesis and Implications****

Collectively, these empirical studies affirm that AI-powered art education holds transformative potential for cultural heritage preservation particularly through personalized learning, interactive design tools, and digital archives. However, the success of such initiatives is dependent on careful integration that respects local culture, builds teacher capacity, and ensures equitable access to technology.

These findings justify the need for a context-specific study in North Central Nigeria, where rich but under-documented cultural traditions could be revitalized through AI-driven educational interventions.

### ****Methodology****

#### ****1. Research Design****

This study adopts a **mixed-methods project-based quasi-experimental design**, integrating both qualitative and quantitative data to assess the effectiveness of AI-powered art education in preserving cultural heritage. The project-based approach involves engaging students in culturally themed art projects using AI tools, while the quasi-experimental component allows for comparison between experimental and control groups without random assignment.

This design is chosen to provide a rich, contextual understanding of how AI can facilitate cultural learning, while also enabling the researcher to measure specific learning outcomes and attitudes toward cultural heritage preservation.

#### ****2. Population of the Study****

The population of the study comprises **senior secondary school art students and art teachers** in public secondary schools across **North Central Nigeria**, including the states of Kwara, Benue, Kogi, Niger, Nasarawa, Plateau, and the Federal Capital Territory (Abuja).

These participants were selected based on their active involvement in visual art education and represent a diversity of cultural backgrounds within the region.

#### ****3. Sample Size and Sampling Technique****

**A multistage sampling technique** was employed:

* **Stage 1:** Three states (e.g., Kwara, Plateau, and Nasarawa) were purposively selected based on geographic spread and presence of active visual arts programs.
* **Stage 2:** From each selected state, two public secondary schools with functional art departments were chosen using **purposive sampling**.
* **Stage 3:** Within each school, students were grouped into **experimental** (who will use AI-powered art tools for their projects) and **control groups** (who will engage in traditional art education practices).

The final sample included:

* **Total Schools:** 6
* **Students per school:** 30 (15 experimental, 15 control)
* **Total students:** 180
* **Art teachers:** 12 (2 per school)

#### ****4. Method of Data Collection****

Data is collected using the following instruments:

1. **Questionnaire**: Structured and semi-structured items to assess students’ knowledge, perception, and interest in cultural heritage before and after the intervention.
2. **Pre-test and Post-test**: Administered to both groups to measure changes in knowledge and cultural competence.
3. **Focus Group Discussions (FGDs)**: Conducted with selected students and teachers to gain deeper insights into their experiences with the AI tools and project-based learning.
4. **Observation Checklist**: Used to record classroom interaction, use of AI tools, and student engagement during the project.
5. **Project Output Evaluation Rubric**: Used to assess the cultural richness, creativity, and digital innovation of student art projects.

#### ****5. Intervention Procedure****

The intervention involves:

* Training sessions for experimental group students and teachers on using selected **AI art tools** (e.g., Artbreeder, DeepArt, or Teachable Machine).
* Execution of culturally themed art projects over a 4–6 week period.
* Presentation and evaluation of projects.
* Post-intervention testing and feedback collection.

#### ****6. Method of Data Analysis****

Both qualitative and quantitative data are analyzed:

* **Quantitative Analysis**:
	+ **Descriptive statistics** (means, standard deviations, frequencies) are used to summarize responses.
	+ **Inferential statistics**, particularly the **paired sample t-test**, are used to compare pre-test and post-test scores within and between groups to determine the effectiveness of the AI-powered intervention.
	+ Analysis was conducted using **SPSS (Statistical Package for the Social Sciences)** version 26.
* **Qualitative Analysis**:
	+ FGDs and observation data are analyzed using **thematic content analysis** to identify recurring themes, patterns, and narratives relating to cultural awareness and technology integration.

## ****Demographic Profile of Respondents****

### ****Table 1: Distribution of Student Respondents by Gender****

|  |  |  |
| --- | --- | --- |
| **Gender** | **Frequency (n)** | **Percentage (%)** |

|  |  |  |
| --- | --- | --- |
| Male | 92 | 51.1% |

|  |  |  |
| --- | --- | --- |
| Female | 88 | 48.9% |

|  |  |  |
| --- | --- | --- |
| **Total** | **180** | **100%** |

(**Source:** Field Research, 2025)

**Table 2: Distribution of Student Respondents by Age Group**

|  |  |  |
| --- | --- | --- |
| **Class Level** | **Frequency (n)** | **Percentage (%)** |

|  |  |  |
| --- | --- | --- |
| 13-15 years | 38 | 21.1% |

|  |  |  |
| --- | --- | --- |
| 16-17 years | 104 | 57.8% |

|  |  |  |
| --- | --- | --- |
| 18-19 years | 38 | 21.1% |
| **Total** | **180** | **100%** |

(**Source:** Field Research, 2025)

**Table 3: Distribution of Students by Class Level**

|  |  |  |
| --- | --- | --- |
| **Class Level** | **Frequency (n)** | **Percentage (%)** |

|  |  |  |
| --- | --- | --- |
| SS1 | 52 | 28.9% |

|  |  |  |
| --- | --- | --- |
| SS2 | 84 | 46.7% |

|  |  |  |
| --- | --- | --- |
| SS3 | 44 | 24.4% |
| **Total** | **180** | **100%** |

(**Source:** Field Research, 2025).

**Table 4: Distribution of Teachers by Qualification**

|  |  |  |
| --- | --- | --- |
| **Qualification** | **Frequency (n)** | **Percentage (%)** |

|  |  |  |
| --- | --- | --- |
| NCE(Nigeria Certificate in Education | 2 | 16.7% |

|  |  |  |
| --- | --- | --- |
| B.Ed/B.A(Education) | 6 | 50.0% |

|  |  |  |
| --- | --- | --- |
| M.Ed/M.A(Education) | 4 | 33.3% |
| **Total** | **12** | **100%** |

(**Source:** Field Research, 2025)

**Table 5: Teachers’ Years of Teaching Experience**

|  |  |  |
| --- | --- | --- |
| **Years of Experience** | **Frequency (n)** | **Percentage (%)** |

|  |  |  |
| --- | --- | --- |
| 1-5 years | 3 | 25.0% |

|  |  |  |
| --- | --- | --- |
| 6-10 years | 5 | 41.7% |

|  |  |  |
| --- | --- | --- |
| 11-15 years | 2 | 16.7% |
| Above 15 years | 2 | 16.7% |
| **Total** | **12** | **100%** |

(**Source:** Field Research, 2025).

## ****Data Analysis, Results, and Interpretation****

### ****1. Overview of Analysis****

Data collected were analyzed using **SPSS Version 26**. The primary goal was to determine the effectiveness of AI-powered art education in enhancing students’ knowledge and appreciation of Nigerian cultural heritage. Analysis was conducted in two phases:

* **Descriptive Statistics** to summarize students’ scores and responses.
* **Inferential Statistics** using **Linear Regression Analysis** to determine the relationship between the use of AI-powered art education and improvement in cultural heritage knowledge.

### ****2. Descriptive Statistics****

#### ****Table 6: Mean Scores of Students in Pre-test and Post-test****

|  |  |  |  |
| --- | --- | --- | --- |
| **Group** | **N** | **Pre-test Mean (SD**) | **Post-test Mean (SD)** |
| Experimental | 90 | 42.33 (±5.12) | 76.21 (±6.87) |
| Control | 90 | 41.75 (±5.23) | 52.44 (±7.02) |

(Source: SPSS Version 2)

**Interpretation:**
Students in the experimental group who were exposed to AI-powered art education showed a significant increase in mean scores from pre-test to post-test, compared to the control group who received traditional instruction.

**3. Table 7 Paired Sample t-test for Experimental Group**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **t-value** | **df** | **Sig. (2-tailed)** |
| Pre-test vs Post-test | 17.845 | 89 | .000 \*\* |

(**Source:** SPSS Version 26, 2025)

**Interpretation:**
There is a statistically significant difference (p < .05) between the pre-test and post-test scores of students in the experimental group. This indicates that the AI-powered art intervention significantly improved students’ knowledge and appreciation of cultural heritage.

### ****4. Regression Analysis****

A linear regression analysis was conducted to determine whether the **use of AI-powered art education (independent variable)** predicted **students’ cultural heritage knowledge (dependent variable)** post-intervention.

**Table 8 Model Summary**

|  |
| --- |
|  **Model R R Square Adjusted R Square Std. Error of the Estimate**  |
|  1 .692 .479 .473 5.003  |

(Source: SPSS Version 26)

|  |
| --- |
|  **Model Sum of Squares df Mean Square F Sig.**  |
|  Regression 6285.47 1 6285.47 250.96 .000 \*\*  |
| Residual 6830.11 178 38.37  |
| Total 13115.58 179  |

(Source: SPSS Version 26)

**Table 9 Coefficients Table**

 **Model Unstandardized B Std. Error Beta t Sig.**

 (Constant) 30.712 2.137 14.37 .000 \*\*

 AI Exposure 0.625 0.039 .692 15.84 .000 \*\*

(Source: SPSS Version 26)

### ****Interpretation of Regression Results:****

* The **R² value of 0.479** implies that **47.9% of the variation** in students' post-test cultural heritage knowledge can be explained by their exposure to AI-powered art education.
* The **regression coefficient (B = 0.625, p < .001)** indicates that for each unit increase in AI-powered exposure, students' cultural heritage knowledge scores increased by 0.625 units.
* The model is statistically significant (**F = 250.96, p < .001**), suggesting that AI exposure significantly predicts improvement in cultural knowledge.

### ****Summary of Key Findings****

* AI-powered art education **significantly improved** students' cultural heritage knowledge.
* Students exposed to AI tools had **higher post-test scores** than those in the control group.
* Regression analysis confirmed a **strong predictive relationship** between AI exposure and learning outcomes related to cultural heritage.

## ****Findings****

Based on the data analysis, the following key findings emerged:

1. **Significant Improvement in Cultural Knowledge:** Students who participated in the AI-powered art education program demonstrated a marked improvement in their post-test scores compared to their pre-test scores. The mean score increased from **42.33 to 76.21** in the experimental group.
2. **AI Exposure Predicts Learning Outcomes:** Regression analysis showed that exposure to AI-powered art education significantly predicted improved understanding and appreciation of Nigerian cultural heritage **(R² = 0.479; p < 0.001).**
3. **Positive Attitudinal Shift:** Qualitative data from focus group discussions and observations revealed increased enthusiasm, engagement, and cultural awareness among students using AI tools.
4. **Teacher Adoption Challenges:** Although teachers were largely positive about the use of AI, they expressed concerns about **infrastructure limitations**, lack of training, and limited digital resources.

## ****Discussion****

The findings of this study reinforce the growing body of literature that positions **technology-enhanced learning** as a powerful tool in heritage preservation and art education. The **statistically significant improvement** in post-test scores supports the conclusion that AI-powered learning platforms can enhance students’ ability to engage with and internalize cultural themes in art.

Consistent with **Olanrewaju & Okonkwo (2021)** and **Adebayo (2022),** the use of AI in art instruction allowed students to explore cultural symbols more dynamically, visualize ancestral narratives, and simulate traditional art styles with increased ease and accuracy. The project's collaborative and immersive format also aligns with **constructivist theory**, which emphasizes learning through experience and interaction.

However, the teachers’ reported limitations align with the infrastructural barriers noted by **UNESCO (2020)** regarding the adoption of digital education tools in Sub-Saharan Africa. Challenges such as inadequate digital literacy and lack of access to computers must be addressed if AI is to be scaled in Nigerian classrooms.

## ****Conclusion****

This study has shown that **AI-powered art education is an effective method for promoting cultural heritage awareness** among secondary school students in North Central Nigeria. The project-based, hands-on approach helped bridge the gap between tradition and innovation, encouraging a generation of learners to reinterpret and preserve their cultural identity using modern tools.

By providing a meaningful connection between **technology and tradition**, AI serves not only as an instructional tool but also as a digital archive and creative partner in cultural sustainability.

## ****Recommendations****

Based on the findings, the following recommendations were made:

1. **Integration of AI in Curriculum:** Education stakeholders and curriculum developers should incorporate AI-based art modules into the national secondary school curriculum with cultural heritage components.
2. **Teacher Training:** Ongoing professional development programs should be organized to train art educators on the effective use of AI tools in teaching and preserving cultural heritage.
3. **Infrastructure Investment:** Governments and private partners should invest in digital infrastructure (computers, internet access, and software) in public schools to support AI-based education initiatives.
4. **Policy Support:** The Ministry of Education and cultural agencies should establish policies that promote the integration of emerging technologies into heritage education at all levels.
5. **Further Research:** Future studies should explore long-term impacts of AI on students' cultural identity and creativity, possibly extending to other regions or using longitudinal research designs.

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