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EFFECT OF ARTIFICIAL INTELLIGENCE ADAPTIVE LEARNING SYSTEM TECHNIQUE ON STUDENTS' INTEREST AND ACHIEVEMENT IN CIVIC EDUCATION IN JOS-NORTH, PLATEAU STATE

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ABSTRACT

The study investigated the effects of Artificial Intelligence (AI) adaptive learning system techniques on students' interest and achievement in Civic Education in Jos-North, Plateau State, Nigeria. Two objectives and null hypotheses were answered and tested. A quasi-experimental design was employed, specifically a non-randomized pre-test post-test non-equivalent control group design. The population consisted of 1,843 Civic Education students in 22 government Upper Basic Two classes. A sample of 60 students was drawn from two intact classes using purposive sampling, followed by a simple balloting system to assign classes to experimental and control groups. Data were collected using the Civic Education Achievement Test (CEAT) and the Civic Education Interest Scale (CEIS). The reliability of the CEIS was assessed using Cronbach's alpha ($\alpha = 0.71$), and the CEAT reliability was determined using the test-retest method ($\alpha = 0.82$). Data were analyzed using inferential statistics (Analysis of Covariance, ANCOVA) to determine the effects of the intervention. The significance level was set at 0.05, and SPSS version 25 was used for data analysis. Post-test results showed a significant improvement in achievement ($F(1,112) = 112.324$, $p < 0.001$) and interest ($F(1,112) = 285.984$, $p < 0.001$) in the experimental group compared to the control group. The study concluded that AI adaptive learning system techniques significantly enhanced students' interest and achievement in Civic Education. It recommended that teachers adopt AI-adaptive instructional techniques to enhance student interest and achievement in Civic Education.

Keywords: ***Effects, Artificial Intelligence, Adaptive Learning System Technique, Interest and Achievement, Civic Education***

INTRODUCTION

Education is recognized globally as a catalyst for personal development, societal progress, and national growth (FRN, 2014). In Nigeria, the National Policy on Education underscores the need to nurture morally sound, patriotic, and self-reliant citizens who contribute to democratic consolidation and socio-economic advancement. Within this framework, Civic Education emerged as a core subject, evolving from Social Studies to address issues of declining civic responsibility, national unity, and weakening ethical values (Idowu, 2017). Its curriculum covers citizenship, human rights, governance, political participation, and conflict resolution, aiming to foster civic consciousness and responsible citizenship (Olayinka, Abdullahi & Abah, 2024). Despite its relevance, Civic Education faces persistent challenges. Many teachers lack adequate pedagogical training, while instructional resources remain insufficient, leading some schools to treat the subject as secondary (Afolabi & Ogundele, 2019; Olayinka & Elijah, 2019). Although Civic Education has encouraged youth activism, peacebuilding, and grassroots participation in some contexts, its overall impact remains constrained, as corruption, political apathy, and indiscipline undermine the values it promotes (Daboer, Iorapuu & Udechukwu, 2021). Furthermore, students' interest in the subject is low due to rote-based instructional methods, abstract curriculum delivery, and the absence of participatory and technology-enhanced learning strategies (Misan-Ruppee, Obro & Akpochafo, 2024).

Achievement in Civic Education spans cognitive, affective, and psychomotor domains (Nnabuike & Agbo, 2022), but these are often limited by ineffective teaching strategies and low prioritization of the subject. To address these gaps, scholars have advocated for innovative pedagogies such as problem-based learning, digital simulations, and adaptive learning tools

(Manabete & Anyim, 2024). In particular, Artificial Intelligence (AI) adaptive learning systems, which personalize content and provide real-time feedback, have shown potential to significantly enhance student engagement and achievement in Civic Education (Nwosu, 2024). Civic Education was designed to instill democratic values and responsible citizenship. However, conventional approaches dominated by rote learning have resulted in declining student interest and poor achievement. Reports from the West African Examinations Council (WAEC) show a three percent annual decline in performance in Civic Education between 2019 and 2023, despite increased enrollment. In Jos-North Local Government Area, challenges such as overcrowded classrooms, inadequate teacher training, and poor instructional resources further constrain effective teaching and learning. While AI adaptive learning systems have been applied successfully in other subjects like Mathematics and English (Nwosu, 2024), they remain largely absent in Civic Education. This study therefore seeks to investigate the effect of AI adaptive learning systems on students' interest and achievement in Civic Education in Jos-North, providing evidence to inform teaching practice and policy reform

OBJECTIVES OF THE STUDY

The main aim of this study is to investigate the Effects of Artificial Intelligence Adaptive Learning System Technique on Students' Interest and Achievement in Civic Education in Jos-North, Plateau State. The specific objectives sought to:

1. examine is the post-test mean scores of students' Achievement in Civic Education in the experimental group and control groups?
2. examine the post-test mean scores of students' Interest in Civic Education between the experimental groups and the control groups.

HYPOTHESES

The following null hypotheses will be tested using .05 level of significance

1. There is no significant difference in the post mean scores of students' Achievement in Civic Education in the experimental group.
2. There is no significant difference in the post-test mean scores of students' interest in Civic Education between the experimental groups and the control groups.

THEORETICAL/CONCEPTUAL FRAMEWORK

This study is grounded in Chaos Theory, proposed by Edward Lorenz (1963), which views learning as a nonlinear and dynamic process influenced by interconnected factors such as student engagement, instructional methods, and attitudes. A central idea of the theory is the butterfly effect, where small changes in teaching strategies or learning conditions can lead to significant differences in outcomes. Key components nonlinearity, self-organization, and interconnectedness highlight how classroom dynamics are complex, adaptive, and sensitive to initial conditions. In this context, the AI adaptive learning system serves as the independent variable, while students' interest and achievement in Civic Education are the dependent variables. The system embodies the principles of Chaos Theory by providing a flexible, personalized learning environment that continuously adjusts to individual learners' needs, preferences, and progress. By collecting and analyzing student data, the AI system delivers tailored content and feedback in real time, ensuring that learners are appropriately challenged. Applying Chaos Theory, this study argues that technology-enhanced, adaptive instruction can significantly improve student engagement and performance compared to rigid, conventional teaching methods. The expectation is that AI adaptive learning systems will foster deeper interest and higher achievement in Civic Education by aligning instruction with individual learning patterns and allowing students to progress at their own pace.

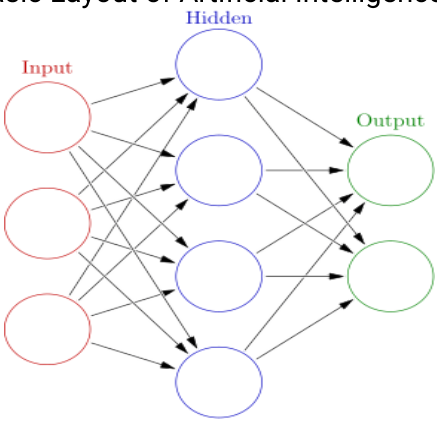
LITERATURE REVIEW

Civic Education has been conceived as a vehicle for cultivating responsible citizenship and strengthening democratic values within Nigerian society. It emphasizes not only knowledge of rights and duties but also the development of attitudes that foster social justice, tolerance, and patriotism (Obiagu and Ajaps, 2022). The objectives are framed around building good citizenry,

promoting national identity, and nurturing political awareness (Obiagu, 2024; Balogun and Yusuf, 2019). Through its curriculum, learners are expected to acquire civic literacy, critical thinking, and dispositions that sustain democratic culture.

Artificial Intelligence adaptive learning systems offer a different paradigm in the instructional process. These systems employ algorithms to tailor educational content, respond to individual learner profiles, and adjust the pace and complexity of instruction (Zhai, Chu, Chai, Jong, Istenic, Spector and Li, 2021; Jamilah and Halimah, 2024). Their promise lies in the capacity to sustain attention, stimulate curiosity, and reduce disparities across diverse learning environments (Joshi, 2024; Ododo, Anwan, Clement, Epoke and Constant, 2024). Yet, obstacles remain: limited infrastructure, inadequate teacher preparation, and questions of data security and cultural relevance continue to constrain their deployment in educational practice (Demartini, Sciascia, Bosso and Manuri, 2024; Al Yakin, Al Matari, Cardoso, Muthmainnah, Nasir, Obaid and Elngar, 2024).

Basic Layout of Artificial Intelligence Systems



Artificial Intelligence (AI) systems are commonly structured into three layers: input, hidden, and output. The input layer receives raw data such as text, images, or student responses, while the hidden layers process this information through interconnected nodes that detect patterns and relationships. Finally, the output layer generates predictions or decisions, such as performance scores, recommendations, or classifications. This layered architecture enables AI to handle complex, nonlinear problems and adapt dynamically to different contexts (Goodfellow, Bengio, Courville & Bengio, 2016).

Common publicly used AI models

Globally, several AI models have become dominant across disciplines. Artificial Neural Networks (ANNs) form the foundation of most systems, while Convolutional Neural Networks (CNNs) excel in image analysis, and Recurrent Neural Networks (RNNs) with Long Short-Term Memory (LSTM) are used for sequential data like speech and language. More recently, transformer -based models such as GPT, Claude, Deepseek and BERT have revolutionized natural language processing, powering applications from chatbots to adaptive learning platforms. These models demonstrate the versatility of AI in education, healthcare, and governance, making them central to innovation in the 21st century (Russell, 2022).

Interest and achievement constitute decisive factors in the study of Civic Education. Interest shapes motivation, directs engagement, and influences the willingness of learners to connect classroom content with lived experience (Hu, 2019; Blume, 2021). Achievement manifests across cognitive, affective, and psychomotor dimensions, reflecting both comprehension and application of civic principles (Nnabuike and Agbo, 2022). Where instruction is limited to rote

recitation, interest wanes and achievement remains shallow (Misan-Ruppee, Obro and Akpochafo, 2024). Interactive methods, including adaptive systems, introduce vitality into the classroom, aligning content with learner needs and producing conditions where motivation and performance are strengthened (Manabete and Anyim, 2024; Nwosu, 2024).

METHODOLOGY

The study employed a quasi-experimental design using a non-equivalent pretest–posttest control group approach. Two intact classes of Upper Basic Two Civic Education students in Jos-North, Plateau State, were assigned as experimental and control groups. The population consisted of 1,843 students across 22 public schools, from which a sample of 60 students was selected using Taro Yamane's formula. Purposive and balloting techniques guided the sampling process to ensure fairness in group assignment. The experimental group was exposed to AI adaptive learning system techniques, while the control group was taught using conventional methods. Pretests and posttests were administered to both groups to establish baseline performance and assess learning gains.

Data were collected using two validated instruments: the Civic Education Achievement Test (CEAT) and the Civic Education Interest Scale (CEIS), both of which were tested for validity and reliability through expert review, pilot testing, and statistical checks (Cronbach's alpha: 0.71 for CEIS, 0.82 for CEAT). Research assistants were trained to ensure unbiased administration of the instruments. Descriptive statistics such as mean and standard deviation summarized responses, while inferential statistics, particularly Analysis of Covariance (ANCOVA), tested the effect of the intervention on students' interest and achievement, controlling for pretest differences. Data analysis was conducted using SPSS version 25, with significance set at 0.05.

RESULTS

The following null hypotheses was tested using .05 level of significance

Hypotheses One: There is no significant difference in the post mean score intervention and treatment in Civic Education in the experimental group.

Table 1: ANCOVA post mean score intervention and treatment in Civic Education in the experimental group

Source	SS	df	MS	F	Sig.
Corrected Model	15879.498[a]	1	15879.498	112.324	0.000
Intercept	388694.095	1	388694.095	2749.443	0.000
Group	15879.498	1	15879.498	112.324	0.000
Error	15833.660	112	141.372		
Total	426426.000	114			
Corrected Total	31713.158	113			

a. R Squared = .501 (Adjusted R Squared = .496)

Source: Researchers SPSS Output (2025)

Table 1 displays the ANCOVA results for post-test mean achievement scores of students in Civic Education after the intervention. The analysis showed a statistically significant main effect of group membership, $F(1,112) = 112.324$, $p = .000$, indicated that the experimental and control groups differed significantly in their post-test achievement scores. The R Squared value of .501 (Adjusted R Squared = .496) implies that approximately 50.1% of the variance in students' post-test achievement could be attributed to the type of instructional method used (AI adaptive learning system versus conventional method). This result leads to the rejection of the null hypothesis and the acceptance of the alternative, which stated that the AI adaptive learning system significantly enhanced the achievement of students in the experimental group compared to their counterparts in the control group. The large effect size further underscores the substantial impact of the intervention on students' learning outcomes in Civic Education.

Hypotheses Two: There is no significant difference in the post-test mean scores of students' interest in Civic Education between the experimental groups and the control groups.

Table 2: ANCOVA post-test mean scores of students' interest in Civic Education between the experimental groups and the control groups

Source	SS	df	MS	F	Sig.
Corrected Model	19446.257[a]	1	19446.257	285.984	0.000
Intercept	582754.046	1	582754.046	8570.202	0.000
Group	19446.257	1	19446.257	285.984	0.000
Error	7615.743	112	67.998		
Total	618038.000	114			
Corrected Total	27062.000	113			

a. R Squared = .719 (Adjusted R Squared = .716)

Source: Researchers SPSS Output (2025)

Table 2 presented the ANCOVA results for post-test mean scores of students' interest in Civic Education between the experimental and control groups. The table indicated that the corrected model was statistically significant, with an F-value of 285.984 and a p-value of .000 for the group variable. Since the p-value was less than the 0.05 level of significance, the null hypothesis was rejected. This result suggested that there was a significant difference in the post-test mean scores of students' interest in Civic Education between those taught with the AI adaptive learning system technique (experimental group) and those taught using the conventional method (control group). The R Squared value of .719 (Adjusted R Squared = .716) indicated that approximately 71.9% of the variance in students' post-test interest scores was explained by the teaching method applied. This is a very high proportion, highlighted that the AI adaptive learning system technique had a substantial effect on improving students' interest compared to the traditional teaching approach. In practical terms, this implies that the experimental group who were exposed to the AI adaptive learning technique developed significantly higher interest in Civic Education than their counterparts in the control group. This demonstrates the effectiveness of technology-driven adaptive strategies in stimulating learner engagement and motivation in Civic Education.

DISCUSSION

Research Hypotheses One the null hypothesis for this research question was rejected, as the assumption of no significant difference was contradicted by the overwhelming statistical evidence. The logical inference was that AI-adaptive instruction significantly enhanced student achievement, and this effect was not only statistically significant but educationally meaningful. This result resonated with the work of Oyeyemi, Okoye, Okenwa-Fadele and Abiakwu (2024), who concluded that AI integration raised performance in Nigerian universities. Yet, the divergence in this study lay in the magnitude of the effect size, which was much larger than previously documented. This novelty suggested that Civic Education, as a discipline often perceived as abstract and underappreciated, might be particularly fertile ground for AI-driven instructional reforms. The implication for educational policy was that AI-based pedagogies should not be limited to science and technical subjects but extended assertively to Civic Education where their impact could be transformative.

Research Hypothesis Two, which stated that there was no significant difference in post-test interest between the two groups, was rejected. The rejection was justified by the overwhelming evidence of a significant difference, both statistically and practically. The logical inference was that AI-adaptive instruction substantially elevated student interest in Civic Education, thereby addressing one of the chronic challenges associated with the subject, namely student apathy and disengagement. This confirmed the conclusion of Oyeyemi, Okoye, Okenwa-Fadele and

Abiakwu (2024), who found that AI rekindled interest in courses otherwise perceived as uninspiring. The divergence of the present study from prior literature was the unusually high proportion of variance explained by the treatment, which suggested not only effectiveness but also dominance of AI in shaping motivational outcomes in Civic Education. The implication was that educators and policy makers should not underestimate the capacity of artificial intelligence to transform student engagement in non-science disciplines.

CONCLUSION

This study conclusively established that AI-adaptive instructional techniques significantly improved both the achievement and interest of students in Civic Education, this study confirmed that AI-adaptive instruction was highly effective in improving both the academic performance and motivational dispositions of students in Civic Education. It provided robust empirical evidence that the integration of artificial intelligence into teaching strategies should no longer be viewed as optional but as an urgent and necessary reform for Nigerian schools.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made: Teachers of Civic Education should adopt AI-adaptive instructional techniques to enhance both achievement and student interest in the subject. School administrators should provide digital infrastructure and resources to support the integration of AI into classroom instruction. Curriculum developers should incorporate AI-adaptive methods into Civic Education syllabi as a formal teaching strategy. Policymakers in the education sector should prioritize investment in teacher training on the use of artificial intelligence tools for effective instruction.

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