STEM Education Review

REVIEW ARTICLE

Blockchain-Assisted Verification and Artificial Intelligence for Enhancing Educational Data Integrity and Learner Performance Evaluation in Conflict-Affected Schools in Nigeria: A Case Study of Zamfara State

Sani Abdullahi Gusa[1,*], Aminu Modi Shagari[2], Abdullahi Mallum Maija[1], Lydia Daniel[1]

[1]Department of History, Federal College of Education, Yola, Adamawa State, Nigeria
[2]Department of Hausa Language, Federal College of Education, Yola, Adamawa State, Nigeria

ABSTRACT

The global expansion of digital educational systems has sharpened scholarly and institutional interest in technologies that can strengthen educational administration, learner evaluation, and data security. This is especially true in conflict-affected regions like northern Nigeria, where educational disruptions, fragmented learner records, and compromised data integrity remain persistent challenges. This study examined how integrating blockchain-assisted verification and artificial intelligence can enhance educational data integrity and learner performance evaluation within conflict-affected schools in Zamfara State, Nigeria. Specifically, it investigated the challenges affecting educational data integrity, assessed the practical applicability of blockchain-assisted verification, evaluated the role of artificial intelligence in learner performance evaluation, and explored the relationship between blockchain systems, artificial intelligence, and educational data integrity. A mixed-methods descriptive survey design was adopted, with structured questionnaires administered to 399 respondents drawn from teachers, school administrators, examination officers, ICT personnel, and educational officials through stratified and purposive sampling. Data were analyzed using descriptive statistics, Pearson Product Moment Correlation, and Simple Linear Regression. The findings showed that blockchain-assisted verification systems significantly improve educational data integrity and institutional trust, while artificial intelligence significantly enhances learner performance evaluation and educational continuity. The study concludes that integrated digital educational technologies hold considerable potential for strengthening educational resilience and digital governance in conflict-affected environments, and recommends increased governmental investment in digital infrastructure, technological training, and supportive policy for blockchain and artificial intelligence integration within Nigerian schools.

Keywords: Blockchain-assisted verification, Artificial intelligence, Educational data integrity, Learner performance evaluation, Conflict-affected schools

INTRODUCTION

The digital transformation of education has moved faster than many institutions—particularly those in fragile or conflict-affected settings—can absorb. Across the world, artificial intelligence (AI), blockchain systems, cloud computing, and learning analytics are reshaping how institutions generate, store, verify, and evaluate edu-

***Corresponding Author:**
Sani Abdullahi Gusau, department of History, Federal College of Education, Yola, Adamawa State, Nigeria. E-mail: abdullahi.sani@fceyola.edu.ng
Received: 9 April 2026; Revised: 14 April 2026; Accepted: 1 August 2026
https://doi.org/10.67229/stemer.26080008

cational information. But these advances have also raised genuine concerns about data security, academic integrity, and equitable access, especially in developing regions where infrastructure remains weak and educational systems routinely face disruption (Bali, Garba, Ahmadu, Takwate & Malgwi, 2024; Theodorio, 2025).

Blockchain technology has attracted particular attention as a decentralized, tamper-resistant digital ledger capable of improving transparency and verification across multiple sectors, education included. Once associated mainly with cryptocurrency, blockchain has since evolved into a broader institutional tool for secure record authentication, digital identity management, and distributed information governance. In schools and universities, it offers a practical mechanism for protecting academic records, preventing certificate forgery, and maintaining learner identity through immutable verification systems that reduce dependence on centralized databases vulnerable to attack or loss (Akinnifesi & Balogun, 2025; Liu, Li, Huang, Li, Wang & Cai, 2023).

Artificial intelligence adds a different but complementary layer of value. AI-driven educational tools are increasingly used for automated assessment, predictive analytics, adaptive learning, and learner monitoring. Within Nigeria, growing scholarly interest has highlighted AI's potential for strengthening educational administration and improving learning outcomes, even as researchers continue to grapple with infrastructural constraints, ethical questions, and inequalities in digital access (Elenode, 2026; Eleje, Ezeugo, Esomonu, Metu, Anierobi, Mbelede, Nwosu, & Ezeonwumelu, 2025).

Zamfara State sits at the intersection of these two technology debates and the very real educational crisis affecting northern Nigeria. Armed banditry and persistent conflict have led to school closures, destruction of educational infrastructure, learner displacement, and the breakdown of administrative systems for record management and academic assessment. UNICEF has documented how this insecurity has intensified educational exclusion, interrupted data continuity, and weakened institutional trust across affected communities (UNICEF, 2025).

The relationship between blockchain technology, AI, and conflict-affected educational systems represents an emerging interdisciplinary concern that has received limited empirical attention. While blockchain can protect educational records from manipulation and loss, AI systems offer tools for analyzing learner performance and anticipating educational risks in unstable environments. Yet concerns persist about implementation costs, digital inequality, data privacy, and institutional readiness in countries like Nigeria. Existing research largely examines blockchain or AI independently, with few studies exploring their combined application in conflict-affected settings (Ouf, Ahmed, & Helmy, 2025; Thompson, Okonkwo, & Obiekwe, 2025).

This study responds directly to that gap. It focuses on Zamfara State precisely because the state has experienced prolonged educational disruptions, displaced learners, and weakened record systems, yet has attracted limited empirical research. By examining how blockchain-assisted verification and AI-driven learner evaluation can jointly strengthen educational data integrity in conflict-prone environments, the study aims to contribute practical insights to educational technology research, policy formulation, and institutional resilience in Nigeria.

Statement of the Problem

The digitalization of educational systems has increased institutional dependence on electronic data management and technology-driven evaluation. In conflict-affected regions of developing countries, however, insecurity, displacement, and infrastructure destruction continue to undermine these systems rather than harness them. In Zamfara State specifically, persistent armed conflict has contributed to school closures, fragmented learner records, disrupted academic evaluation, and a broader erosion of confidence in educational data management (UNICEF, 2025; Theodorio, 2025).

Blockchain and AI offer credible responses to these challenges, but their adoption in Nigerian conflict-affected schools faces real obstacles: poor digital infrastructure, limited ICT readiness, unstable operating conditions, and weak institutional capacity. Existing research in this area has largely concentrated on higher education systems and digital innovation in developed societies, with limited attention to how these technologies might work together in fragile, conflict-affected settings. Zamfara State remains notably underexamined despite its acute educational vulnerabilities (Eleje et al., 2025; Ouf et al., 2025; Akinnifesi & Balogun, 2025).

This study is therefore necessary. It seeks to address the challenges of educational data vulnerability and unreliable learner performance evaluation in conflict-affected schools through an integrated technological framework, and to provide practical recommendations for improving educational continuity and data reliability in such environments.

Objectives of the Study

This study aims to examine the integration of blockchain-assisted verification and AI in enhancing educational data integrity and learner performance evaluation within conflict-affected schools in Nigeria, using Zamfara State as a case study. Specifically, it seeks to:

1. examine the challenges affecting educational data integrity in conflict-affected schools in Zamfara State;

2. assess the applicability of blockchain-assisted verification systems in securing educational records in those schools;
3. evaluate the role of AI in improving learner performance evaluation; and
4. investigate the relationship between blockchain-assisted verification, AI, and educational data integrity in conflict-affected schools in Zamfara State.

Research Questions

The following research questions guided the study:

1. What are the major challenges affecting educational data integrity in conflict-affected schools in Zamfara State?
2. How applicable are blockchain-assisted verification systems in securing educational records in conflict-affected schools?
3. What role does AI play in improving learner performance evaluation in conflict-affected schools?
4. What relationship exists between blockchain-assisted verification, AI, and educational data integrity in conflict-affected schools in Zamfara State?

Hypotheses

H_{01}: Blockchain-assisted verification systems have no significant relationship with educational data integrity in conflict-affected schools in Zamfara State.

H_{02}: Artificial intelligence has no significant influence on learner performance evaluation in conflict-affected schools in Zamfara State.

Scope of the Study

This study focuses on the integration of blockchain-assisted verification and AI in enhancing educational data integrity and learner performance evaluation within conflict-affected schools in Zamfara State, Nigeria. It examines challenges related to educational record management, learner assessment, data security, and technological readiness in schools affected by insecurity and displacement. The study is geographically limited to selected conflict-affected schools in Zamfara State and conceptually concentrated on blockchain-assisted verification systems, AI applications, educational data integrity, and learner performance evaluation. Participants include teachers, school administrators, ICT personnel, and educational officials connected to educational data management processes.

CONCEPTUAL REVIEW

Blockchain-Assisted Verification Systems

Blockchain-assisted verification systems are decentralized digital frameworks designed to ensure the security, authenticity, transparency, and immutability of institutional records through cryptographic validation. Unlike traditional centralized databases that can be manipulated, lost, or altered without detection, blockchain systems maintain permanent verification trails that strengthen institutional trust and educational accountability. In educational contexts, blockchain has been applied to certificate authentication, learner identity continuity, and secure academic record management. Nigerian studies have observed that these systems hold considerable potential for reducing record falsification and improving educational transparency, despite the infrastructural and technological limitations that remain prevalent across many institutions in developing societies (Akinnifesi & Balogun, 2025; Yusuf, Ibrahim, & Abdullahi, 2024).

Artificial Intelligence in Education

Artificial intelligence in education refers to the application of intelligent computational systems that simulate human reasoning, prediction, analysis, and decision-making within teaching, learning, and educational management processes. AI increasingly supports adaptive learning, learner monitoring, automated assessment, predictive analytics, and personalized instruction in modern institutions. In Nigeria, the growing integration of AI into educational administration has generated debates around technological readiness, digital inequality, ethical concerns, and data privacy. Nonetheless, researchers argue that AI holds substantial capacity for improving learner performance evaluation and institutional efficiency, particularly within unstable educational environments affected by insecurity and infrastructure disruption (Eleje et al., 2025; Elenode, 2026).

Educational Data Integrity

Educational data integrity concerns the accuracy, consistency, reliability, availability, and security of educational records throughout their lifecycle within institutional management systems. It encompasses the need to ensure that learner information, examination records, academic transcripts, and institutional reports remain authentic, protected, and retrievable without unauthorized modification or destruction. In conflict-affected environments, educational data integrity faces heightened vulnerability due to school attacks, displacement, technological weaknesses, and poor administrative systems. Recent Nigerian educational studies indicate that weaknesses in digital educational governance continue to undermine confidence in learner records, result processing, and institutional accountability across many schools and educational agencies (Theodorio, 2025; Thompson et al., 2025).

Learner Performance Evaluation

Learner performance evaluation encompasses the systematic assessment and measurement of learners' aca-

demic achievement, progression, skills acquisition, participation, and overall educational outcomes through formal and informal assessment mechanisms. Traditional evaluation methods depend heavily on examinations, continuous assessment, and manual grading, all of which may become unreliable within conflict-affected environments marked by displacement, interrupted schooling, and administrative instability. Contemporary educational systems increasingly turn to digital technologies and AI-assisted analytics to improve the reliability, efficiency, and predictive capability of learner assessment. Nigerian educational scholars contend that technology-supported evaluation can significantly enhance educational continuity and institutional responsiveness within unstable learning environments (Bali et al., 2024).

Theoretical Framework: Technology Acceptance Model

This study is anchored on the Technology Acceptance Model (TAM), developed by Fred Davis in 1989 to explain how and why users accept and use technological systems within institutional environments. TAM holds that the intention to adopt a technological innovation depends primarily on two perceptions: usefulness and ease of use. The model has become one of the most influential frameworks in educational technology research because it helps explain how individuals and institutions respond to emerging technologies such as AI, blockchain-assisted verification systems, and digital educational management platforms (Davis, 1989; Eleje et al., 2025).

The theory's central proponents—Davis, Bagozzi, and Warshaw—emphasized that technology adoption is shaped by behavioral intention, user perception, and institutional attitudes toward new systems. Technologies perceived as beneficial, efficient, accessible, and compatible with institutional needs are more likely to gain acceptance. TAM's core principles therefore revolve around perceived usefulness, perceived ease of use, behavioral intention, and actual system utilization. Recent Nigerian educational studies have increasingly applied TAM to explain the adoption of digital learning systems and AI-assisted tools within higher educational institutions and administrative systems (Elenode, 2026; Thompson et al., 2025).

TAM's relevance to this study lies in its capacity to explain how educational stakeholders in Zamfara State may perceive and accept blockchain-assisted verification and AI. The theory provides a suitable framework for understanding institutional readiness, technological acceptance, and behavioral responses toward innovations designed to strengthen educational data integrity and learner performance evaluation. In this context, blockchain-assisted verification and AI are treated as technological innovations whose adoption depends on how useful and accessible stakeholders perceive them to be. TAM therefore provides the analytical foundation for examining how technological perceptions influence the integration of these systems in conflict-affected educational environments.

RESEARCH METHODOLOGY

This study adopted a mixed-methods descriptive survey research design, combining quantitative data from structured questionnaires with supplementary qualitative insights from interview responses. The instrument consisted primarily of four-point Likert scale items (Strongly Agree, Agree, Disagree, Strongly Disagree). The study population comprised school administrators, teachers, examination officers, ICT personnel, officials of the Ministry of Education, and educational monitoring officers connected to conflict-affected schools in Zamfara State.

The sample size of 399 respondents was determined using the Taro Yamane (1967) formula at a 0.05 margin of error and 95% confidence level. Stratified and purposive sampling techniques were employed to ensure adequate representation across participant categories. Table 1 below presents the population distribution and derived sample sizes.

Table 1: Sample Size

S/N	Target Population Category	Population	Sample Size
1	School Administrators / Principals		14
2	Teachers		344
3	Examination Officers		16
4	ICT Personnel		13
5	Ministry of Education Officials		7
6	Educational Monitoring Officers		5
	Total		399

Source: Fieldwork, 2026

The validity of the research instrument was established through expert review and content validation, ensuring clarity, relevance, and alignment with the study's objectives. Reliability was determined using Cronbach's Alpha, which confirmed adequate internal consistency of the questionnaire items prior to administration.

DATA PRESENTATION AND ANALYSIS

Respondents' Profile

Table 2 shows that male respondents constituted the majority at 64% (n=255), while female respondents accounted for 36% (n=144). This distribution likely reflects the gender composition of educational administration and ICT roles in Zamfara State, where male participation in

formal educational employment remains higher.

Table 2: Sex of Respondents

Sex	Frequency	Percentage (%)
Male	255	64%
Female	144	36%
Total	399	100%

Source: Fieldwork, 2026

Table 3 indicates that the largest age group was 18–35 years (36%, *n*=144), while respondents aged 66 and above were least represented (18%, *n*=71). The relatively young age profile of participants suggests a workforce that may be more open to digital educational innovations.

Table 3: Age Distribution of Respondents

Age Group	Frequency	Percentage (%)
18–35 years	144	36%
36–55 years	96	24%
56–65 years	88	22%
66 years and above	71	18%
Total	399	100%

Source: Fieldwork, 2026

Table 4 reveals that NCE holders formed the majority (52%, *n*=208), followed by first degree holders (36%, *n* =144), with only 3% holding PhD qualifications. This distribution is consistent with the qualification profile typical of basic and secondary school teachers in Zamfara State.

Table 4: Level of Education of Respondents

Level of Education	Frequency	Percentage (%)
NCE	208	52%
First Degree	144	36%
Master's Degree	36	9%
PhD	11	3%
Total	399	100%

Source: Fieldwork, 2026

Table 5 shows that the majority of respondents (57%, *n* =227) had 16 or more years of working experience, indicating a largely experienced sample whose assessments carry practical authority.

Table 6 shows that most respondents were from public primary schools (57%, *n*=227), followed by public secondary schools (35%), with private schools representing just 8%. This is consistent with the predominantly public structure of basic education in Zamfara State.

Table 5: Years of Working Experience

Years of Working Experience	Frequency	Percentage (%)
1–5 Years	124	31%
6–10 Years	28	7%
11–15 Years	20	5%
16 Years and above	227	57%
Total	399	100%

Source: Fieldwork, 2026

Table 6: School Type of Respondents

School Type	Frequency	Percentage (%)
Public Primary School	227	57%
Public Secondary School	140	35%
Private School	32	8%
Total	399	100%

Source: Fieldwork, 2026

Table 7 reveals that slightly more respondents were drawn from urban schools (58%, *n*=231) than rural schools (42%, *n*=168), although the significant rural representation ensures that findings reflect conditions across both settings.

Table 7: School Location

School Location	Frequency	Percentage (%)
Rural	168	42%
Urban	231	58%
Total	399	100%

Source: Fieldwork, 2026

Table 8 indicates that just over half of respondents (54%, *n*=215) confirmed the availability of ICT facilities in their schools, while 46% reported the absence of adequate ICT infrastructure. This near-even split underscores the mixed state of digital readiness across Zamfara schools.

Table 8: Availability of ICT Facilities in Schools

Availability of ICT Facilities	Frequency	Percentage (%)
Yes	215	54%
No	184	46%
Total	399	100%

Source: Fieldwork, 2026

Table 9 shows that 81% (*n*=323) of respondents had not experienced direct conflict-related disruption at the time of the survey, while 19% confirmed having done so. The

Table 9: Experience of Conflict-Related Disruption

Experience of Conflict-Related Disruption	Frequency	Percentage (%)
Yes	76	19%
No	323	81%
Total	399	100%

Source: Fieldwork, 2026

Table 10: Access to Digital Educational Systems

Level of Access to Digital Educational Systems	Frequency	Percentage (%)
Adequate	84	21%
Moderate	116	29%
Poor	128	32%
None	71	18%
Total	399	100%

Source: Fieldwork, 2026

Table 11: Challenges Affecting Educational Data Integrity in Conflict-Affected Schools in Zamfara State

S/N	Challenges to Educational Data Integrity	SA	A	D	SD	Mean	Std. Dev
1	Educational records are frequently lost or damaged due to conflict-related school closures.	178	132	51	38	3.13	0.94
2	Manual record systems in our schools are highly vulnerable to unauthorized alterations.	163	140	57	39	3.07	0.96
3	Learner academic records are difficult to retrieve following conflict-induced displacement.	171	135	53	40	3.10	0.95
4	Weak administrative systems undermine the consistency and reliability of educational data.	159	138	61	41	3.04	0.97
5	Institutional trust in educational data management is low due to frequent disruptions.	155	142	62	40	3.03	0.96
	Grand Mean					3.07	0.96

Source: Fieldwork, 2026

19% who experienced disruption still represent a substantial group given the study's focus on conflict-affected schools.

Table 10 reveals that access to digital educational systems was predominantly poor or non-existent among respondents. Only 21% (n=84) reported adequate access, while 32% described their access as poor and 18% had none at all. Taken together, half of all respondents operate in conditions of severely limited digital access, a finding that contextualizes the technology integration challenges examined throughout this study.

Analysis of Research Questions

Table 11 presents respondents' perceptions of the challenges affecting educational data integrity in conflict-affected schools. All five items returned mean scores above 3.00 on a four-point scale, with a grand mean of 3.07 (SD=0.96), indicating a strong overall agreement that educational data integrity is seriously compromised in Zamfara's conflict-affected schools. Item 1 recorded the highest mean (3.13), reflecting near-universal agreement that conflict-related school closures lead to frequent loss or damage of educational records. Item 5 recorded the lowest mean (3.03), though still well above the threshold for agreement, showing that respondents recognize the erosion of institutional trust as a consequence of persistent disruptions. These results confirm that educational data vulnerability in the study area is not merely perceived but is a widely experienced operational reality.

Table 12 shows respondents' assessments of the applicability of blockchain-assisted verification systems. The grand mean of 3.07 (SD=0.96) reflects a consistently positive evaluation across all five items. Item 1 attracted the highest agreement (mean=3.12), indicating confidence that blockchain can effectively secure educational records against manipulation. Item 5 attracted the lowest agreement (mean=3.01), suggesting some caution regarding the feasibility of adoption without external support—an understandable concern given the digital infrastructure deficits documented in Table 10. Overall, however, respondents perceived blockchain-assisted verification as both applicable and potentially transformative for securing educational records in the study area.

Table 12: Applicability of Blockchain-Assisted Verification Systems in Conflict-Affected Schools

S/N	Applicability of Blockchain-Assisted Verification Systems	SA	A	D	SD	Mean	Std. Dev
1	Blockchain-assisted systems can effectively secure educational records against manipulation.	175	136	49	39	3.12	0.95
2	Blockchain technology can help maintain continuous learner identity records during displacement.	168	139	53	39	3.09	0.95
3	Decentralised verification systems would reduce reliance on vulnerable centralised databases.	161	143	56	39	3.07	0.95
4	Blockchain-assisted systems can improve transparency in educational administration.	164	138	57	40	3.07	0.96
5	Schools in this area can realistically adopt blockchain verification systems with proper support.	153	140	64	42	3.01	0.97
	Grand Mean					3.07	0.96

Source: Fieldwork, 2026

Table 13: Role of Artificial Intelligence in Learner Performance Evaluation

S/N	Role of Artificial Intelligence in Learner Performance Evaluation	SA	A	D	SD	Mean	Std. Dev
1	AI-assisted systems can accurately monitor and evaluate learner academic progress.	172	138	51	38	3.11	0.94
2	AI-driven predictive analytics can identify at-risk learners before academic failure occurs.	165	141	54	39	3.08	0.95
3	Automated AI assessment tools can improve consistency in learner evaluation during disruptions.	161	140	59	39	3.06	0.96
4	AI tools can support educational continuity for displaced learners through personalized learning.	158	143	59	39	3.05	0.96
5	AI educational systems have the potential to improve learning outcomes in conflict-affected schools.	155	144	61	39	3.04	0.96
	Grand Mean					3.07	0.95

Source: Fieldwork, 2026

Table 14: Relationship Between Blockchain, AI, and Educational Data Integrity

S/N	Blockchain, AI, and Educational Data Integrity (Combined Relationship)	SA	A	D	SD	Mean	Std. Dev
1	Integrating blockchain and AI can significantly strengthen educational data integrity.	174	137	50	38	3.12	0.94
2	Combined digital systems would improve institutional accountability in conflict-affected schools.	166	140	54	39	3.09	0.95
3	Blockchain and AI integration can support educational resilience during insecurity.	162	141	57	39	3.07	0.95
4	The combined adoption of these technologies is feasible with appropriate policy support.	158	142	60	39	3.05	0.96
5	Integrated digital technologies would improve educational data governance in Zamfara State.	155	143	62	39	3.04	0.96
	Grand Mean					3.07	0.95

Source: Fieldwork, 2026

Table 13 reveals strong agreement regarding the potential role of AI in improving learner performance evaluation (grand mean=3.07, SD=0.95). Item 1 recorded the highest mean (3.11), reflecting confidence that AI can accurately monitor and evaluate learner progress. Item 5 returned the lowest mean (3.04), though still clearly above the agreement threshold, suggesting that respondents are optimistic about AI improving learning outcomes even in conflict-affected contexts, while perhaps exercising some caution about systemic implementation. The overall pattern confirms that educational stakeholders in Zamfara State see AI as a valuable tool for learner assessment, particularly in environments where traditional evaluation methods have been disrupted.

Table 14 demonstrates strong agreement that the combined integration of blockchain and AI can meaningfully strengthen educational data integrity and institutional governance in conflict-affected schools (grand mean=3.07, SD=0.95). Item 1 returned the highest mean (3.12), indicating strong consensus that integrated digital systems can significantly improve educational data integrity. Item 5 recorded the lowest mean (3.04), reflecting measured confidence about implementation in Zamfara State specifically—though the mean still clearly falls within the agreement range. These findings suggest that respondents view the combined adoption of blockchain and AI not as a theoretical aspiration but as a practically desirable and achievable direction for educational governance.

Inferential Analysis

Hypothesis One

H_{01}: Blockchain-assisted verification systems have no significant relationship with educational data integrity in conflict-affected schools in Zamfara State.

Table 15 reveals a strong positive correlation between

Table 15: Pearson Correlation – Blockchain-Assisted Verification and Educational Data Integrity

Variables	*N*	Mean	Std. Deviation	*r*-value	Sig. (2-tailed)
Blockchain-Assisted Verification Systems	399	2.86	1.04	0.682	0.000
Educational Data Integrity	399	2.91	1.01		

Source: Fieldwork, 2026

Table 16: Simple Linear Regression – Artificial Intelligence and Learner Performance Evaluation

Variables	B	Std. Error	Beta	*t*-value	Sig.
Constant	1.214	0.224		5.421	0.000
Artificial Intelligence	0.673	0.071	0.711	9.482	0.000

Source: Fieldwork, 2026

Table 17: Model Summary

R	R Square	Adjusted R Square	Std. Error of Estimate
0.711	0.506	0.501	0.318

Source: Fieldwork, 2026

blockchain-assisted verification systems and educational data integrity (r=0.682, p=0.000). Since the significance value is below the 0.05 threshold, the null hypothesis is rejected. This means that blockchain-assisted verification systems significantly contribute to strengthening educational data integrity, record protection, and institutional trust within conflict-affected schools in Zamfara State.

Hypothesis Two

H_{02}: Artificial intelligence has no significant influence on learner performance evaluation in conflict-affected schools in Zamfara State.

Table 16 confirms that AI significantly influences learner performance evaluation in conflict-affected schools in Zamfara State (Beta=0.711, t=9.482, p=0.000). The null hypothesis is therefore rejected. The R^2 value of 0.506 indicates that AI accounts for approximately 50.6% of the variance in learner performance evaluation within the study area, representing a substantial and practically meaningful predictive relationship.

Table 17 assesses the overall explanatory power of artificial intelligence regarding learner performance evaluation in conflict-affected schools in Zamfara State. The correlation coefficient (R = 0.711) shows a strong linear relationship between the variables. The R^2 value of 0.506 indicates that artificial intelligence accounts for 50.6% of the variance in learner performance evaluation, with a standard error of 0.318.

Discussion of Findings

The findings paint a consistent picture: conflict-affected schools in Zamfara State are operating under conditions of serious educational data vulnerability, and both blockchain-assisted verification and AI offer credible pathways to address those vulnerabilities. Descriptive results showed high levels of agreement among respondents regarding record loss, weak verification systems, and the fragility of manual educational databases in conflict-prone environments. Inferential analysis reinforced these perceptions with statistical evidence, demonstrating significant relationships between blockchain systems and educational data integrity, and between AI and learner performance evaluation.

These findings correspond with Akinnifesi and Balogun (2025), who observed that blockchain technology significantly improves educational data protection and record verification within vulnerable institutional systems. Similarly, Yusuf et al. (2024) argued that decentralized digital verification systems can reduce educational record manipulation and strengthen institutional transparency in developing countries. The present study's findings do diverge somewhat from Thompson et al. (2025), who emphasized that technological limitations and infrastructural deficiencies may constrain the practical implementation of digital educational systems in rural and conflict-affected Nigerian communities—a tension reflected in this study's own data on poor digital access.

The finding that respondents viewed blockchain-assisted

systems as applicable and useful for protecting educational records aligns with the integrated framework proposed by Ouf et al. (2025), who maintained that blockchain systems improve educational accountability and data reliability within digitally managed learning environments. Liu et al. (2023) similarly concluded that blockchain-assisted educational management systems significantly reduce the risk of record falsification and institutional data vulnerability. The partial contrast with Bali et al. (2024), who argued that low technological literacy and limited ICT infrastructure hinder advanced technology adoption in developing societies, is visible in this study's finding that nearly half of respondents lacked adequate ICT facilities—a constraint that must be addressed for any blockchain or AI adoption strategy to succeed.

The finding that AI significantly predicts learner performance evaluation in conflict-affected schools is consistent with Eleje et al. (2025), who established that AI enhances educational planning, learner assessment, and academic performance evaluation within Nigerian educational institutions. Elenode (2026) similarly observed that AI-supported learning analytics improve predictive assessment and educational decision-making. The slight divergence from Theodorio (2025), who highlighted cybersecurity threats and poor digital governance as constraints on AI effectiveness in fragile institutional environments, is an important practical qualifier: the positive perceptions captured in this study may partly reflect aspirational views rather than current operational realities.

The combined integration of blockchain and AI emerged from both descriptive and inferential analyses as the configuration most likely to strengthen educational resilience and institutional accountability. This finding aligns with Thompson et al. (2025), who argued that integrated digital technologies can improve educational governance in evolving societies, and with Ouf et al. (2025), who demonstrated that combining blockchain with intelligent learning technologies enhances educational security, data reliability, and administrative efficiency. UNICEF's (2025) caution about the ongoing impact of insecurity and infrastructure destruction as obstacles to technology implementation in northern Nigeria remains relevant and should temper the optimism of these findings with appropriate policy realism.

CONCLUSION

This study set out to examine how integrating blockchain-assisted verification and AI could enhance educational data integrity and learner performance evaluation in conflict-affected schools in Zamfara State, Nigeria. The findings confirm that insecurity, educational disruption, weak digital infrastructure, and poor record management systems continue to undermine educational administration and learner assessment in the state. At the same time, the study demonstrated that blockchain-assisted verification systems hold considerable potential for strengthening educational data security and institutional trust, while AI significantly improves learner performance evaluation, monitoring, and predictive assessment. Crucially, the combined integration of these technologies appears to offer something greater than the sum of its parts: enhanced educational resilience, continuity, accountability, and digital governance that neither technology achieves as effectively in isolation. The study therefore concludes that technological innovation is not optional but essential for strengthening educational systems and protecting educational data integrity within conflict-affected regions of Nigeria.

RECOMMENDATIONS

Based on the study's findings, the following recommendations are offered:

1.The government should establish secure digital educational infrastructure capable of supporting blockchain-assisted verification systems for protecting learner records and strengthening educational data integrity in conflict-affected schools across Zamfara State and other vulnerable regions.

2. The Ministry of Education should introduce institutional policies encouraging the gradual adoption of AI for learner performance evaluation, educational planning, and predictive academic assessment within conflict-affected educational environments.

3. School administrators should strengthen ICT readiness through regular digital training programs designed to improve the capacity of teachers and examination officers to manage blockchain-assisted verification and AI-supported learner assessment systems.

4. Educational policymakers should allocate increased financial resources toward the provision of reliable internet connectivity, digital equipment, and educational technology infrastructure required for sustainable digital educational management in conflict-affected schools in northern Nigeria.

5. Educational institutions should collaborate with technology experts and software developers to design locally adaptable blockchain-assisted educational management systems capable of functioning effectively within unstable and resource-constrained environments.

6. Security agencies and community stakeholders should support educational continuity by strengthening school protection mechanisms to reduce conflict-related disruptions affecting educational record management, learner assessment, and institutional administrative processes.

7. Researchers and higher educational institutions should conduct further interdisciplinary studies examining the long-term effectiveness, ethical implications, and sustainability of blockchain and AI integration within Nigerian educational systems and conflict-affected societies.

DECLARATION

Acknowledgement
Not applicable.

Author Contributions
Below shows a sample Author Contributions section written based on the CRediT:

Conceptualization: Ali Jackson, Helen Meyer

Investigation: Ali Jackson, Tom Lewis-Hans, Han Xiang

Methodology: Dolores Hans

Formal analysis: Han Xiang

Writing - original draft: Ali Jackson

Writing - review & editing: Helen Meyer, Joshua O'Brien

Source of funding
Self - finding.

Ethical approval
Not applicable.

Informed consent
Not applicable.

Conflict of interest
The authors declare no competing interest.

Data availability statement
No additional data.

REFERENCES

Akinnifesi, O. O., & Balogun, A. A. (2025). Blockchain technology and educational data security in Nigerian institutions. Nigerian Journal of Educational Technology, 12(1), 44–59.

Bali, B., Garba, E. J., Ahmadu, A. S., Takwate, K. T., & Malgwi, Y. M. (2024). Analysis of emerging trends in artificial intelligence for education in Nigeria. Discover Artificial Intelligence, 4(110), 1–18. https://doi.org/10.1007/s44163-024-00233-5

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340. https://doi.org/10.2307/249008

Eleje, L. I., Ezeugo, N. C., Esomonu, N. P. M., Metu, I. C., Anierobi, E. I., Mbelede, N. G., Nwosu, K. C., & Ezeonwumelu, V. U. (2025). Artificial intelligence adoption in higher education in Nigeria. Discover Artificial Intelligence, 5(335), 1–14. https://doi.org/10.1007/s44163-025-00312-x

Elenode, A. W. (2026). Adoption of generative AI and learning analytics for personalised learning in Nigerian higher education: Effects on student engagement, learning outcomes, and academic integrity. Engineering and Applied Sciences Journal, 11(1), 1–5.

Liu, Y., Li, K., Huang, Z., Li, B., Wang, G., & Cai, W. (2023). EduChain: A blockchain-based education data management system [arXiv preprint arXiv:2306.00553]. https://doi.org/10.48550/arXiv.2306.00553

Ouf, S., Ahmed, S., & Helmy, Y. (2025). A blockchain based deep learning framework for a smart learning environment. Scientific Reports, 15, Article 19519. https://doi.org/10.1038/s41598-025-03688-z

Theodorio, A. O. (2025). Discerning cyber threats in an era of digitally connected classrooms: Lessons for the Nigerian higher education system and society. Discover Computing, 28, Article 68. https://doi.org/10.1007/s10791-025-09501-2

Thompson, C. C., Okonkwo, S., & Obiekwe, K. K. (2025). Ethics and bias in AI-driven education and security management in Nigerian schools. UNIZIK Journal of Educational Management and Policy, 7(1), 85–97.

UNICEF. (2025). The impact of insecurity on access to education in Katsina, Zamfara and Niger States. UNICEF Nigeria.

Yamane, T. (1967). Statistics: An introductory analysis (2nd ed.). Harper & Row.

Yusuf, M. A., Ibrahim, A. U., & Abdullahi, S. M. (2024). Digital governance and blockchain adoption in educational administration in Nigeria. African Journal of Information Systems, 16(2), 88–103.