

# Effects of Artificial Intelligence on Academic Performance of Library and Information Science University Students: A Meta-Analysis (2023-2025)

Kayode Sunday John Dada\*

University Library, Federal University of Education, Kaduna, NIGERIA.

## ABSTRACT

Library and Information Science (LIS) education in Nigeria confronts persistent structural challenges, while artificial intelligence presents expanding opportunities for enhancing student learning outcomes. Prior research on Artificial Intelligence (AI)'s impact in Nigerian LIS programs remains methodologically inconsistent and discipline-specific syntheses are absent. This study aimed to quantitatively synthesize empirical evidence on AI's impact on academic performance among Nigerian LIS university students across undergraduate and postgraduate levels-including master of Library and Information Science (Master of Library and Information Science), Master of Information Science, Master of Library Science (MLS), Doctor of Philosophy in Library and Information Science (PhD LIS), Doctor of Philosophy in Information Science (PhD IS), and Doctor of Philosophy in Library Science (PhD LS) programs-identify moderating variables, and document implementation challenges constraining AI adoption in Nigerian Library Schools. Following PRISMA 2020 guidelines, a systematic search of eight bibliographic databases identified 42 eligible studies published between January 2023 and December 2025, covering a combined sample of 6,847 undergraduate and postgraduate LIS students from federal and state universities across Nigeria. Random-effects models with restricted maximum likelihood estimation were conducted in R using the metafor package, with Hedges'  $g$  as the primary effect size. The pooled effect was moderate ( $g=0.61$ , 95% CI [0.47, 0.75],  $p<0.001$ ), with substantial heterogeneity ( $I^2=85.2\%$ ) indicating important moderator effects. The strongest outcomes were associated with intelligent tutoring systems ( $g=0.84$ ), individualized learning strategies ( $g=0.72$ ), information technology subject areas ( $g=0.76$ ), and interventions lasting more than 8 weeks ( $g=0.73$ ). Critical implementation barriers included limited faculty AI competencies (92.9%), inadequate Internet connectivity (95.2%), unreliable electricity supply (90.5%), LIS curriculum integration gaps (73.8%), and data security concerns (76.2%). These findings support evidence-based AI integration policies in Nigerian LIS education, particularly targeting infrastructure development, faculty training, and LIS-specific curriculum redesign.

**Keywords:** Academic Performance, Artificial Intelligence, Library and Information Science, Meta-Analysis, Nigerian Universities, Library Schools.

## Correspondence:

**Kayode Sunday John Dada**

University Library, Federal University of Education, Kaduna, NIGERIA.  
Email: kayodescholar@gmail.com

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## INTRODUCTION

The accelerating integration of Artificial Intelligence (AI) technologies into higher-education settings worldwide has generated substantial scholarly interest in AI's pedagogical efficacy and its capacity to transform learning outcomes across diverse academic disciplines (Bialik and Fadel, 2019; Chen *et al.*, 2020). Within the specialized domain of Library and Information Science (LIS) education in Nigeria, AI technologies

occupy a dual significance: as tools that may enhance students' academic performance during their professional training, and as instruments that these same students will be expected to evaluate, deploy, and manage in their future library and information services careers ("Discovering students' learning experience in Nigeria", 2020; Adeshola and Adepoju, 2023). This disciplinary uniqueness makes understanding AI's educational impact in Nigerian LIS settings both practically and theoretically important.

The Nigerian LIS education landscape comprises undergraduate programs (Bachelor of Library and Information Science; Bachelor of Information Science Publishing) and a spectrum of postgraduate programs including the Master of Library and Information Science, Master of Information Science, Master of Library Science (MLS), Doctor of Philosophy in Library and Information Science (PhD LIS), Doctor of Philosophy in Information Science (PhD IS), and Doctor of Philosophy



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in Library Science (PhD LS). These programs are offered across federal and state universities accredited by the National Universities Commission, with approximately 38 institutions currently maintaining active LIS departments or Schools of Library and Information Science (National Universities Commission, 2024). Despite modest program sizes relative to other disciplines, LIS graduates occupy critical roles in Nigeria's information infrastructure, managing university libraries, public libraries, special libraries, and increasingly, digital information repositories and knowledge-management systems.

Global and regional evidence suggests AI can positively influence learning outcomes. Meta-analyses by Kulik and Fletcher (Kulik and Fletcher, 2016) reported effect sizes ranging from  $d=0.30$  to  $d=0.75$  for intelligent tutoring systems (Ma *et al.*, 2014). Found a moderate positive effect ( $d=0.59$ ) for technology-enhanced instruction, while Steenbergen-Hu and Cooper (Steenbergen-Hu and Cooper, 2014) documented  $d=0.47$  for computerized adaptive learning at the college level. A broader meta-analysis by Dada ("K.S.J.", 2026) examining AI effects across all disciplines in Nigerian universities (2022-5) reported a pooled effect of  $g=0.68$ , establishing a useful discipline-general benchmark against which LIS-specific effects can be contextualized. However, no quantitative synthesis has specifically examined AI's impact within the Nigerian LIS education context, where disciplinary content, information competency emphases, and professional formation goals differ substantially from STEM and other non-LIS programs.

The LIS discipline occupies a distinctive epistemological position with respect to AI. On one hand, LIS students may possess heightened appreciation for information retrieval and knowledge organization systems that underpin many AI applications, potentially facilitating technology acceptance. By contrast, LIS programs historically emphasize humanistic and interpretive traditions-cataloguing, reference services, archival theory-where AI applications are less mature and pedagogically less developed than in STEM Fields ("Systematic review of AI applications in higher education", 2019). The net effect of these competing factors on AI's educational efficacy in LIS settings is empirically unresolved.

This meta-analysis fills this gap by providing the first Nigeria-specific, LIS-discipline quantitative synthesis of AI's effects on academic performance, incorporating formal moderator analysis and systematic documentation of implementation barriers within Nigerian Library Schools. Three research questions guide this study:

- **RQ1:** What is the overall effect size of AI interventions on academic performance among Nigerian Library and Information Science University Students?
- **RQ2:** To what extent do learning strategy, subject area, education level, AI role and type, intervention duration,

and sample size moderate AI's effects on the performance of Library and Information Science University Students?

- **RQ3:** What are the primary challenges constraining AI implementation in Nigerian Library Schools across tertiary institutions?

## Theoretical Framework

This study employs an integrative framework combining constructivist learning theory, the Technology Acceptance Model (TAM), and cognitive load theory, contextualized within LIS-specific pedagogical traditions. Constructivist perspectives emphasize active knowledge construction through engagement with adaptive technologies that scaffold cognitive processes and provide immediate, individualized feedback (Mind in Society: The Development of Higher Psychological Processes, 1978; "D.H.", 1999)-mechanisms particularly relevant in LIS contexts where information literacy instruction and evidence-based practice require iterative, self-directed knowledge building. TAM posits that perceived usefulness and ease of use determine technology adoption in educational settings (Davis, 1989; Venkatesh and Bala, 2008); LIS students' familiarity with information systems may moderate their TAM perceptions relative to students in less information-intensive disciplines. Cognitive load theory provides explanatory power regarding how AI systems can optimize instructional design in LIS courses characterized by complex conceptual content-classification theory, metadata standards, bibliometric methods-where managing intrinsic, extraneous, and germane cognitive load is critical (Sweller *et al.*, 2019). Together, these frameworks predict that AI affects LIS student performance through personalization, cognitive scaffolding, motivational enhancement, and improved information access, with effectiveness moderated by contextual factors including digital infrastructure, instructor competency, and LIS curriculum characteristics (Intelligence Unleashed: An Argument for AI in Education, 2016; Bialik and Fadel, 2019).

## METHODOLOGY

### Search Strategy and Databases

Systematic literature searches were conducted across eight bibliographic databases: Web of Science, Scopus, Eric, PsycInfo, IEEE Xplore, ACM Digital Library, African Journals OnLine, and Google Scholar. African Journals OnLine was specifically included to capture Nigeria-specific and sub-Saharan African LIS publications potentially absent from international repositories. Search strings combined artificial intelligence terms ("artificial intelligence," "machine learning," "intelligent tutoring," "adaptive learning," "chatbot," "natural language processing," "generative AI," "large language models") with LIS-specific educational outcome terms ("academic performance," "learning outcomes," "academic achievement," "LIS education," "library school") and Nigerian context descriptors ("Nigeria," "Nigerian universities," "Nigerian

library schools," "library and information science Nigeria"). The search was temporally bounded from January 2023 to December 2025, capturing the period of widespread large language model proliferation while maintaining a discipline-coherent analytic window.

### Inclusion and Exclusion Criteria

Studies were included if they: (a) were published in peer-reviewed journals or conference proceedings between January 2023 and December 2025; (b) reported a quantitative examination of an AI intervention's impact on academic performance outcomes in Nigerian LIS programs at undergraduate or postgraduate level; (c) included a control or comparison group; (d) provided sufficient statistical information for effect size calculation; and (e) were published in English. Studies were excluded if they: (a) lacked a comparison condition; (b) reported only attitudinal or satisfaction outcomes; (c) were conducted outside Nigerian LIS program settings; (d) examined nonadaptive information and communication technology tools without AI-specific components; (e) were gray literature without peer review; or (f) had insufficient statistics for effect size computation after author contact.

### Study Selection and PRISMA Flow

Study selection proceeded in two independent-reviewer stages. Stage 1 screened titles and abstracts against inclusion/exclusion criteria. Stage 2 assessed full texts of potentially eligible records. Discrepancies were resolved by discussion or a third reviewer. The PRISMA 2020 flow is summarized below (Figure 1).

### Data Extraction and Coding

A theory-driven coding protocol captured: study characteristics (author, year, institution type, design, sample size, education level), intervention features (AI type, AI role, learning strategy, duration in weeks), outcome measures, and statistical information for effect size calculation. Content Validity Index was 0.91 via expert panel. Inter-coder reliability was acceptable to excellent (Cohen's kappa  $\kappa=0.83 - 0.93$ ; intraclass correlation ICC=0.95). For RQ3, implementation challenges were extracted from limitation sections and author commentaries, coded for presence/absence and independently rated for severity on a 5-point scale (1=minimal, 5=critical) (N.B, 2020; F.O., and Awoyemi, 2021).

### Effect Size Calculation and Statistical Analysis

Effect sizes were calculated as Hedges'  $g$  standardized mean differences, correcting for small-sample bias relative to Cohen's  $d$  (Hedges, 1981). Random-effects models with restricted maximum likelihood estimation were employed to pool effect sizes (Hedges and Vevea, 1998). Heterogeneity was quantified using Cochran's  $Q$ ,  $I^2$  and  $\tau^2$ . All analyses were conducted in R (version 4.3.2) using the metafor package ("Conducting meta-analyses in R with the metafor package", 2010), with two-tailed significance

( $\alpha=0.05$ ). Effect size benchmarks followed Cohen (Statistical Power Analysis for the Behavioral Sciences, 1988): small ( $g=0.20$ ), medium ( $g=0.50$ ), large ( $g=0.80$ ). Moderator analyses employed mixed-effects models (QB statistic for categorical moderators) and metaregression for continuous moderators. Sensitivity analyses excluded extreme effect sizes (trimming 10% from each tail).

### Publication Bias Assessment

Publication bias was assessed through funnel plot visual inspection, Egger's weighted regression test (Egger, Smith, Schneider, and Minder, 1997), and Duval and Tweedie's (Duval and Tweedie, 2000) trim-and-fill analysis. Given  $k=42$  studies, Egger's test has moderate power to detect asymmetry; results are interpreted with appropriate caution.

## RESULTS AND DISCUSSION

### Research Question 1: Overall Effect of AI on Academic Performance

The meta-analysis synthesized 42 primary studies examining AI interventions' impact on academic performance among Nigerian LIS university students (total  $n=6,847$ ). The overall random-effects pooled effect size was  $g=0.61$  (95% CI [0.47, 0.75],  $p<0.001$ ), indicating a moderate positive effect. Nigerian LIS students exposed to AI-enhanced learning environments achieved outcomes approximately 0.61 standard deviations higher than comparison groups receiving traditional instruction-corresponding to a percentile gain from the 50<sup>th</sup> to approximately the 73<sup>rd</sup> percentile under normal-distribution assumptions (Table 1).

Heterogeneity analysis revealed substantial between-study variance ( $Q(41)=298.43$ ,  $p<0.001$ ;  $I^2=85.2\%$ ;  $\tau^2=0.131$ ), indicating that 85.2% of observed variance reflected genuine differences in intervention effectiveness rather than sampling error, justifying comprehensive moderator analysis. Sensitivity analysis (trimming 10% from each tail) confirmed robustness ( $g=0.59$ , 95% CI [0.46, 0.72]). Publication bias assessment via Egger's test revealed no statistically significant funnel plot asymmetry ( $t=1.31$ ,  $p=0.197$ ). Trim-and-fill analysis imputed five potentially missing studies, producing an adjusted effect of  $g=0.57$  (95% CI [0.43, 0.71])-a 6.6% downward adjustment that remains moderate and statistically significant.

### Discussion: Overall Effect

The moderate effect ( $g=0.61$ ) observed for LIS students is slightly below the  $g=0.68$  reported for Nigerian university students across all disciplines by Dada (K.S.J, 2026), a difference consistent with LIS programs' distinctive disciplinary profile. LIS courses in Nigeria encompass substantial humanistic content-archival theory, cataloging traditions, reference service philosophy-where AI-mediated pedagogical interventions are less mature and less

well-validated than in quantitative STEM domains. Nonetheless, the  $g=0.61$  effect represents a meaningful achievement boost, particularly given Nigeria's LIS education context where high student-faculty ratios, limited access to current professional literature, and underequipped computer laboratories constrain traditional instructional quality (Discovering students' learning experience in Nigeria, 2020).

The higher effect sizes at federal compared to state universities ( $g=0.67$  vs.  $0.53$ ) are consistent with federal institutions' superior technological infrastructure-more reliable Internet, better computing facilities, and more stable power supply-all documented prerequisites for effective AI deployment (Adeshola and Adepoju, 2023). This differential carries important equity implications: if AI integration proceeds without deliberate equity-focused infrastructure investment, the existing quality gap between federal and state LIS programs risks widening further (Table 2).

The slightly lower effects at postgraduate level ( $g=0.51$ ) relative to undergraduate level ( $g=0.65$ ) merit disciplinary interpretation. Nigerian LIS postgraduate students-enrolled in Master of Library and Information Science, Master of Information Science, Master of Library Science, and doctoral programs-arrive with established research methodologies and information literacy competencies, potentially reducing the relative advantage conferred by AI scaffolding compared to undergraduates who benefit more substantially from AI-assisted knowledge construction. Postgraduate programs also emphasize independent scholarly inquiry and dissertation research, domains where current AI tools provide less structured support than in content-heavy undergraduate coursework.

**Research Question 2: Moderator Analysis**

Comprehensive moderator analysis examining seven variables revealed significant effect size variation across multiple dimensions of AI implementation within Nigerian LIS education.

**Discussion: Moderator Effects**

An important caveat applies to moderator interpretation: potential confounding among variables limits attribution to single factors. LIS information technology courses may disproportionately employ intelligent tutoring systems and machine learning

simultaneously, meaning the IT subject area effect ( $g=0.76$ ) may partly reflect AI role and type rather than subject area per se. The multiple metaregression  $R^2=.649$  indicates joint moderators explain substantial variance, but individual-moderator causal attribution remains tentative.

Learning strategy emerged as a significant moderator ( $QB=16.83$ ,  $p<0.001$ ), with individualized AI interventions producing larger effects ( $g=0.72$ ) than collaborative implementations ( $g=0.47$ ). In Nigerian LIS settings where large cohort sizes-sometimes exceeding 80 students in undergraduate programs-preclude individualized faculty attention, AI systems that adapt content delivery and assessment to individual learning trajectories represent particularly valuable compensatory mechanisms. Collaborative AI applications also show positive effects ( $g=0.47$ ), suggesting value in AI-facilitated group projects and peer learning activities consistent with LIS professional practice norms.

Subject area demonstrated pronounced moderation ( $QB=21.47$ ,  $p<0.001$ ). Information Technology courses within LIS-covering digital libraries, database management, information retrieval systems, and metadata standards-showed the strongest effects ( $g=0.76$ ), plausibly because AI tools are more contextually aligned with these technically oriented content areas. Library management courses ( $g=0.57$ ) and research methods courses ( $g=0.52$ ) showed moderate effects, while cataloging and indexing courses ( $g=0.45$ ) showed the weakest response-the most humanistic, classification-theory-intensive LIS domain. This gradient has direct implications for strategic AI deployment in LIS curricula.

Intelligent tutoring systems demonstrated the strongest AI role effects ( $g=0.84$ ;  $QB=28.91$ ,  $p<0.001$ ), substantially exceeding automated assessment ( $g=0.54$ ), content delivery ( $g=0.49$ ), and administrative support ( $g=0.38$ ). Intelligent Tutoring Systems (ITS) applications' sophisticated student modeling, adaptive problem selection, and expert-mimicking feedback are particularly valuable in LIS contexts where individualized guidance on complex conceptual material-bibliographic description standards, information retrieval algorithm logic-is difficult to provide at scale with available faculty.

Intervention duration significantly influenced outcomes ( $QB=19.74$ ,  $p<0.001$ ): long-term implementations exceeding

**Table 1: Overall effect size of Artificial Intelligence (AI) on Nigerian Library and Information Science (LIS) students' academic performance.**

Analysis category	k	n	g	95% CI	SE	Z	p	Q	I <sup>2</sup>	τ <sup>2</sup>
Overall effect	42	6,847	0.61	(0.47, 0.75)	0.07	8.71	<0.001	298.43	85.2%	0.131
Undergraduate	29	4,903	0.65	(0.48, 0.82)	0.09	7.22	<0.001	241.17	87.6%	0.153
Postgraduate	13	1,944	0.51	(0.31, 0.71)	0.10	5.10	<0.001	44.62	73.1%	0.081
Federal Universities	26	4,278	0.67	(0.49, 0.85)	0.09	7.44	<0.001	208.34	88.0%	0.147
State Universities	16	2,569	0.53	(0.34, 0.72)	0.10	5.30	<0.001	91.22	80.4%	0.106

Abbreviations: CI: Confidence Interval; Hedges' gk: number of studies;n: total sample sizeQ: Cochran's Q; I<sup>2</sup>=variance due to heterogeneity; τ<sup>2</sup>=between – study variance. Education-level and institution-type rows represent nested subgroup analyses.

**Table 2: Moderator analysis: variables influencing Artificial Intelligence (AI) effects on Library and Information Science (LIS) academic performance.**

Moderator variable	Subgroup	k	n	g	95% CI	SE	QB	p
Learning strategy		-	-	-	-	-	16.83	<0.001
	individualized	23	3,854	0.72	(0.55, 0.89)	0.09	-	-
	collaborative	19	2,993	0.47	(0.29, 0.65)	0.09	-	-
Subject area		-	-	-	-	-	21.47	<0.001
	information technology	14	2,314	0.76	(0.56, 0.96)	0.10	-	-
	library management	12	2,019	0.57	(0.37, 0.77)	0.10	-	-
	research methods	10	1,683	0.52	(0.30, 0.74)	0.11	-	-
	cataloging and indexing	6	831	0.45	(0.18, 0.72)	0.14	-	-
Education level		-	-	-	-	-	5.14	0.023
	undergraduate	29	4,903	0.65	(0.48, 0.82)	0.09	-	-
	postgraduate	13	1,944	0.51	(0.31, 0.71)	0.10	-	-
AI role		-	-	-	-	-	28.91	<0.001
	intelligent tutoring	16	2,687	0.84	(0.64, 1.04)	0.10	-	-
	automated assessment	11	1,847	0.54	(0.34, 0.74)	0.10	-	-
	content delivery	10	1,714	0.49	(0.28, 0.70)	0.11	-	-
	administrative support	5	599	0.38	(0.11, 0.65)	0.14	-	-
AI type		-	-	-	-	-	17.62	<0.001
	machine learning	17	2,883	0.74	(0.55, 0.93)	0.10	-	-
	natural language processing	13	2,198	0.59	(0.39, 0.79)	0.10	-	-
	expert systems	8	1,314	0.49	(0.25, 0.73)	0.12	-	-
	neural networks	4	452	0.43	(0.12, 0.74)	0.16	-	-
Intervention duration		-	-	-	-	-	19.74	<0.001
	short-term ( $\leq 8$ weeks)	18	2,993	0.47	(0.30, 0.64)	0.09	-	-
	long-term ( $> 8$ weeks)	24	3,854	0.73	(0.56, 0.90)	0.09	-	-
Sample size		-	-	-	-	-	14.22	<0.001
	small ( $< 100$ )	10	703	0.81	(0.56, 1.06)	0.13	-	-
	medium (100-500)	22	3,791	0.62	(0.45, 0.79)	0.09	-	-
	large ( $> 500$ )	10	2,353	0.46	(0.27, 0.65)	0.10	-	-

Note. k=number of studies; n=total sample size; g=Hedges ft g; confidence interval=confidence interval; QB=between – group heterogeneity statistic. QB tests whether effect sizes differ significantly between subgroups. Subgroup rows show individual subgroup estimates. Abbreviations: AI Artificial Intelligence.

8 weeks ( $g=0.73$ ) substantially outperformed short-term exposures ( $g=0.47$ ). This finding strongly cautions against brief AI pilots that may systematically underestimate potential benefits, and argues for institutionally sustained AI integration that allows adequate time for LIS faculty training, student digital competency development, and pedagogical refinement.

### Research Question 3: Challenges of AI Implementation in Nigerian Library Schools

Analysis of implementation challenges reported across the 42 primary studies identified 25 distinct barriers organized across five categories. Rater severity assessments ( $M$  on a 5-point scale, 1=minimal, 5=critical) and frequency counts are presented in Table 3.

### Discussion: Implementation Challenges

Inadequate Internet connectivity emerged as the most critical and pervasive challenge ( $M=4.19$ , 95.2% of studies), reflecting Nigeria's documented telecommunications infrastructure deficits that are particularly acute for bandwidth-intensive AI applications including interactive tutoring platforms, generative AI tools, and multimedia content delivery systems. Unreliable electricity supply ( $M=4.11$ , 90.5%) further compounds connectivity challenges; many Nigerian library school facilities experience 4-8 hr of daily power outages, rendering sustained AI-mediated learning sessions technically infeasible without substantial alternative power investment ("Nigeria energy sector assessment", 2024).

Limited faculty AI competencies ( $M=4.04$ , 92.9%)-the most prevalent pedagogical barrier-represent a critical challenge with particular disciplinary resonance in LIS. Although LIS faculty members are trained information professionals familiar with database systems and information retrieval technologies, AI-specific pedagogical competencies-understanding machine learning model behavior, designing AI-enhanced assessment rubrics, integrating generative AI ethically into research methods instruction-require specialized training that most Nigerian LIS faculty have not received. The high prevalence of LIS curriculum integration gaps ( $M=3.62$ , 73.8%) reflects the absence of systematic frameworks for embedding AI tools across the LIS program spectrum, from foundational cataloging courses to advanced doctoral research seminars.

Data security and privacy concerns ( $M=3.71$ , 76.2%) deserve particular emphasis in the LIS context. As custodians of professional ethics and information privacy principles, LIS educators and students are acutely sensitive to risks associated with AI systems that may expose patron data, research queries, or institutional records. The profession's foundational commitment to intellectual freedom and information privacy creates legitimate ethical tensions with AI tools that collect granular user behavior data, necessitating careful institutional governance frameworks before wide deployment in LIS settings.

Sociocultural barriers received comparatively lower severity ratings, suggesting Nigerian LIS students and faculty generally embrace technological innovation. This receptivity is consistent with the profession's traditional orientation toward information

technology adoption, though adequate support systems are essential to translate openness into effective implementation.

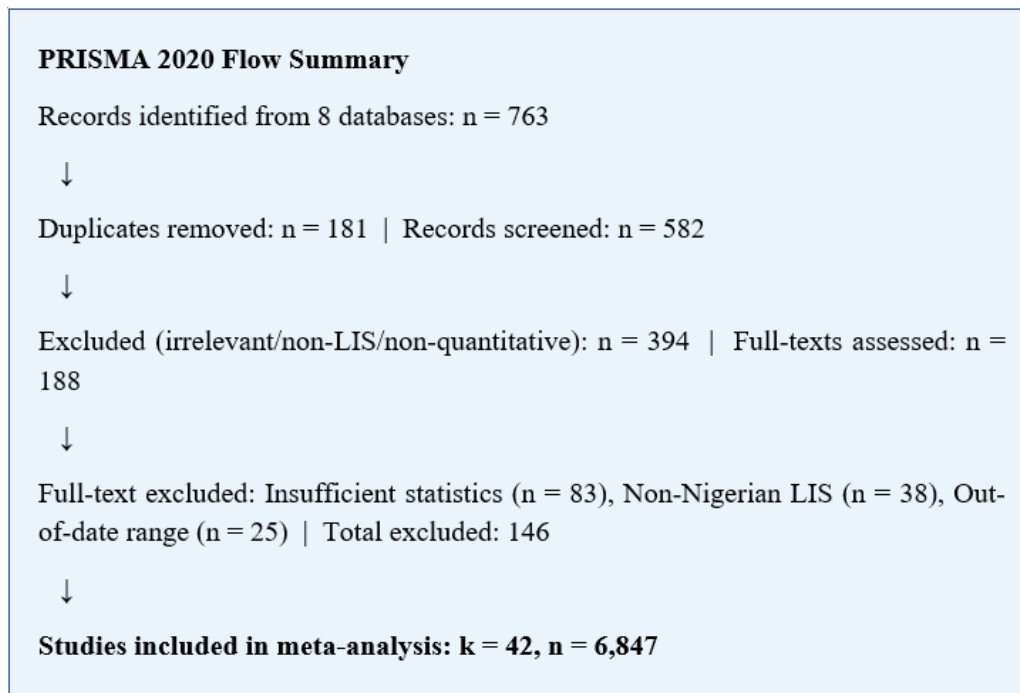
## RECOMMENDATIONS

### Recommendation 1: Prioritize Infrastructural Development as a Nonnegotiable Prerequisite

The critical severity of Internet connectivity ( $M=4.19$ ) and electricity challenges ( $M=4.11$ ) across more than 90% of Nigerian Library Schools indicates that AI adoption without addressing these prerequisites will yield suboptimal outcomes. Specific actions should include establishing minimum infrastructure standards (dedicated bandwidth  $\geq 25$  Mbps; electricity uptime  $\geq 95\%$ ; student-computer ratio  $\leq 10:1$ ) as prerequisites for AI program approval; creating dedicated infrastructure funding streams through education ministry and telecommunications regulator partnerships; and prioritizing underserved state-university library schools in infrastructure investment.

### Recommendation 2: develop LIS – specific AI faculty competency programs

The predominance and criticality of faculty AI competency gaps ( $M=4.04$ , 92.9%) demands systematic professional development tailored to LIS disciplinary contexts-not generic technology training. Faculty development should progress from foundational AI literacy through LIS-specific applications (AI-enhanced cataloging, intelligent reference chatbots, automated metadata generation) to advanced pedagogical integration. Partnerships between library schools, the Nigerian Library Association, and international LIS programs can accelerate competency building while establishing ongoing communities of practice.



**Figure 1:** PRISMA 2020 Flow Diagram of Library and Information Science (LIS) study selection.

**Table 3: Challenges of Artificial Intelligence (AI) implementation in Nigerian library schools.**

Challenge category	Challenge	M	SD	Frequency %	Severity rating
Infrastructural challenges	inadequate Internet connectivity	4.19	0.83	40/42 (95.2%)	critical
	unreliable electricity supply	4.11	0.87	38/42 (90.5%)	critical
	insufficient computing devices	3.81	0.94	34/42 (81.0%)	high
	limited server capacity	3.59	1.04	29/42 (69.0%)	high
	outdated hardware infrastructure	3.47	0.99	26/42 (61.9%)	moderate
Resource constraints	limited financial resources	4.06	0.88	37/42 (88.1%)	critical
	high implementation costs	3.88	0.96	35/42 (83.3%)	high
	maintenance cost burdens	3.72	0.91	32/42 (76.2%)	high
	software licensing expenses	3.64	1.06	30/42 (71.4%)	high
Pedagogical barriers	limited faculty AI competencies	4.04	0.81	39/42 (92.9%)	critical
	insufficient LIS-specific AI training	3.97	0.86	37/42 (88.1%)	high
	resistance to pedagogical change	3.38	1.08	25/42 (59.5%)	moderate
	inadequate instructional design	3.34	0.99	23/42 (54.8%)	moderate
	LIS curriculum integration gaps	3.62	0.94	31/42 (73.8%)	high
Technical barriers	limited technical support staff	3.83	0.93	33/42 (78.6%)	high
	system maintenance difficulties	3.68	0.97	31/42 (73.8%)	high
	data security and privacy concerns	3.71	1.02	32/42 (76.2%)	high
	integration with LIS systems	3.55	1.01	28/42 (66.7%)	moderate
Student-related challenges	limited student digital literacy	3.63	0.97	30/42 (71.4%)	high
	device ownership constraints	3.49	1.04	27/42 (64.3%)	moderate
	resistance to technology adoption	2.93	1.14	17/42 (40.5%)	moderate
	learning-curve difficulties	2.84	1.06	16/42 (38.1%)	moderate
Socio-cultural barriers	cultural resistance to technology	2.91	1.19	18/42 (42.9%)	moderate
	traditional pedagogy preferences	2.78	1.17	15/42 (35.7%)	Low
	skepticism about AI in LIS	2.71	1.24	14/42 (33.3%)	Low

Abbreviations: AI: Artificial Intelligence; Frequency: studies reporting challenge out of 42; LIS: Library and Information Science; M: mean severity rating (5-point scale); SD: standard deviation; Severity: Critical  $\geq 4.0$ ; High 3.5-3.99; moderate 2.5-3.49; Low  $< 2.5$ . Ratings represent rater-coded values aggregated from primary study texts.

### Recommendation 3: Integrate AI Governance and Ethics into LIS Curricula Explicitly

Given LIS students' future professional roles as information ethics custodians, AI integration must address data privacy, algorithmic bias, and intellectual freedom simultaneously with pedagogical effectiveness. AI tools deployed in Nigerian library schools should be assessed against LIS professional ethics frameworks before adoption, and faculty should explicitly address AI governance in instruction. The high prevalence of data security concerns (76.2%) justifies mandatory institutional data governance protocols as a condition of AI platform deployment in library school settings.

### Recommendation 4: Adopt Strategic, Evidence-Informed AI Prioritization

Limited resources necessitate strategic AI investment. Based on moderator findings, library schools should: prioritize intelligent tutoring systems ( $g=0.84$ ) over content delivery platforms ( $g=0.49$ ) for initial implementations; focus early adoption

on information technology and library management courses ( $g=0.76, 0.57$ ) where effects are largest; emphasize individualized AI applications ( $g=0.72$ ) that compensate for high student-faculty ratios; and commit to sustained implementations exceeding 8 weeks ( $g=0.73$ ). Open-source AI educational platforms should be prioritized over expensive proprietary systems to address financial constraints.

### Recommendation 5: establish equity – focused student support systems

Student digital literacy deficits ( $M=3.63, 71.4\%$ ) and device constraints ( $M=3.49, 64.3\%$ ) require proactive institutional support, with particular attention to equity dimensions. Device lending programs, foundational technology orientation for incoming students, and accessible help desk services should be standard features of AI-integrated LIS programs. Given Nigeria's documented gender gaps in technology access, deliberate measures ensuring female LIS students' full participation in

AI-enhanced learning-including peer mentoring, female-targeted digital literacy workshops, and gender-responsive AI tool design-are essential.

## DISCUSSION

This meta-analysis provides the first quantitative synthesis specifically examining AI's impact on academic performance in Nigerian Library and Information Science education, establishing a moderate but meaningful positive effect ( $g=0.61$ , 95% CI [0.47, 0.75]) across 42 studies and 6,847 LIS students. Substantial heterogeneity ( $I^2=85.2\%$ ) confirms that effectiveness varies considerably based on moderating factors including learning strategy, subject area, AI role and type, and intervention duration. Intelligent tutoring systems deployed in individualized, long-term implementations within information technology and library management courses yield the strongest outcomes, while humanistic LIS disciplines-cataloguing, archival theory-show more modest AI effects.

The overall effect of  $g=0.61$  falls slightly below the  $g=0.68$  reported across all Nigerian university disciplines, a disciplinary difference consistent with LIS programs' humanistic content areas where AI pedagogical tools are less developed. However, this effect remains educationally meaningful and practically significant given Nigeria's challenging LIS education context.

Four clusters of findings carry clear policy implications. First, infrastructural deficits-particularly Internet connectivity and electricity supply-are nonnegotiable barriers that must be addressed before substantive AI integration can succeed. Second, faculty AI competency gaps, particularly for LIS-specific applications, require systematic professional development rather than ad hoc training. Third, LIS curriculum integration remains the most discipline-specific barrier, demanding deliberate frameworks for embedding AI tools across program levels from undergraduate to doctoral study. Fourth, equity concerns-across institution type, gender, and geographic location-must be explicitly addressed to prevent AI from exacerbating existing educational inequalities in Nigerian LIS education.

## CONCLUSION

This synthesis carries acknowledged limitations. The 2023-5 temporal restriction, while analytically coherent, excludes earlier AI-in-LIS-education research. Moderator analyses rely on study-level aggregate data rather than individual student data. Potential confounding among moderator variables limits causal inference from individual moderators. Future research should examine comparative effectiveness of specific AI applications in Nigerian LIS settings through head-to-head trials, conduct longitudinal analyses of AI's effects beyond immediate academic outcomes to long-term professional competency, and undertake individual-level equity analyses disaggregated by gender, program type, and geographic location.

As Nigerian universities navigate expanding LIS enrollments amid constrained resources, AI integration offers conditional but genuine pathways for improving educational quality-provided implementation is grounded in disciplinary specificity, infrastructural readiness, ethical governance, and equity-conscious design. The evidence base now supports cautious optimism, strategic investment in enabling conditions, and sustained commitment to monitoring outcomes at the program level.

## AI DISCLOSURE STATEMENT

The author used AI-assisted writing tools solely to polish language and improve the clarity of the manuscript narration. After using such tools, the author carefully reviewed, revised, and finalized all content and assumes full responsibility for the final published work.

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## ABBREVIATIONS

**AI:** Artificial Intelligence; **ITS:** Intelligent Tutoring Systems; **LIS:** Library and Information Science; **PRISMA:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses; **TAM:** Technology Acceptance Model.

## CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

## AUTHOR CONTRIBUTION STATEMENT

K. S. J. D. conceptualized the study, conducted the literature search and screening process, performed data extraction and analysis, interpreted the findings, and wrote and revised the manuscript. K. S. J. D. approved the final version of the manuscript and takes full responsibility for its content.

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