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Transforming Library and Information Science through Digital Learning Integration: A Conceptual Framework

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Highlights:

Introduces the DLIF-LIS framework, a three-node conceptual model.

Explains how institutional policy, educator readiness, and curriculum design interact to shape digital literacy outcomes.

Revealed that digital learning integration is not just desirable but an ethical and national development necessity, offering actionable recommendations for curriculum planners, institutions, and policymakers.

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Abstract: This paper introduces the Digital Learning Integration Framework for Library and Information Science (DLIF-LIS), a three-node conceptual model designed to operationalise the transformation of LIS education in Nigerian Colleges of Education and universities. The framework maps three interdependent dimensions: curricular revision as the input node, faculty technology-pedagogical modelling as the process node, and the production of digitally competent information professionals as the output node. Anchored in Connectivism and the Technological Pedagogical Content Knowledge (TPACK) model, the DLIF-LIS provides an explanatory architecture for understanding how institutional policy, educator readiness, and curricular design interact to determine the digital literacy outcomes of LIS graduates. Drawing on verified empirical literature from Nigerian and international LIS contexts, the paper documents the systemic failure of existing LIS programmes to produce graduates aligned with the digital demands of contemporary information practice. The paper advances the position that digital learning integration is a professional, ethical, and national development imperative, marshals literature-backed arguments in support of that position, confronts key counterarguments, and derives actionable recommendations for curriculum planners, faculty, and policymakers. The DLIF-LIS offers LIS educators, institutional administrators, and accreditation bodies a structured, implementable model for driving digital transformation in Nigerian information science education.

Keywords: Library transformation, Digital learning integration,Teacher-librarians

Introduction

Libraries and information systems have always mirrored the informational needs of the societies they serve. When those needs shift, as they have so dramatically over the past three decades in response to digital technology, libraries and the professionals who staff them are compelled to shift as well. In Nigeria, this adjustment has been notably slow in the domain of formal LIS education. While the broader higher education system has grappled with the challenges of digital transition, LIS programmes at Colleges of Education and universities have, in many cases, continued to train future information professionals using curricula and instructional modes that predate the internet era (Abubakar, 2021).

LIS professionals are, by the nature of their vocation, information gatekeepers and educators. They shape how students, researchers, civil servants, and citizens interact with recorded knowledge. When LIS educators are not conversant with digital tools, digital databases, e-learning environments, and information literacy frameworks suited to the digital age, the

information services they provide and the graduates they train reflect those limitations. The downstream consequences are felt across education, healthcare, public administration, and research.

This paper holds the following central position: the full and systematic integration of digital learning into Library and Information Science education in Nigerian Colleges of Education and universities is a professional, ethical, and national development imperative that can no longer be deferred. This position rests on three pillars. The first is the professional reality that LIS has been transformed by digital technology to its very core, and any LIS education that does not reflect this transformation produces graduates misaligned with professional reality. The second pillar is the educational responsibility of LIS teacher educators: teachers who are not themselves digitally competent cannot produce digitally capable students, and Colleges of Education hold a particular obligation given their mandate to prepare teachers for the entire educational system. The third pillar is national development: Nigeria's ambitions for a knowledge economy require citizens with advanced information skills, and LIS professionals trained in digital environments are uniquely positioned to cultivate those skills across communities.

RECONSTRUCTING NIGERIAN LIS EDUCATION: REALITIES AND SYSTEMIC STRESS

2.1 The Status Quo: Curricula, Infrastructure, and the Competency Gap

Nigeria's LIS education landscape is extensive. As of 2020, researchers identified 30 to 31 LIS departments actively offering programmes in Nigerian universities, alongside additional programmes in Colleges of Education and polytechnics (Eze & Aduba, 2022). This reach, however, has not translated into uniformly updated curricula or digitally equipped faculties. Research consistently identifies a gap between the competencies modern LIS practice demands and those graduating students actually possess.

Okeji and Mayowa-Adebara (2020), in a study covering 31 NUC-approved LIS programmes, found that while most LIS schools included digital library-related content in their curricula, very few had functional computer laboratories with internet connectivity. This infrastructure deficiency means that teaching digital library skills remains largely theoretical, producing graduates who know about digital tools but lack hands-on competence. Abubakar (2021) similarly identified government underfunding, inadequate infrastructure, and a shortage of faculty with advanced digital competencies as central constraints on meaningful curriculum reform.

Okeji, Ilika, and Baro (2020), whose survey reached 1,350 final-year LIS undergraduates across 15 universities, found that while students rated their general information-organising ability highly, they reported significant deficiencies in paraphrasing sources to avoid plagiarism and applying citation styles consistently. These gaps indicate an incomplete information literacy training that points to curricula which teach about information without adequately teaching students to use it in digitally mediated ways. Alex-Nmecha and Ejitagha (2023) found that LIS undergraduates in Nigerian universities had limited competencies in digital content creation, the ethical use of digital information, and the evaluation of online sources for credibility. These are not peripheral skills; they define what it means to be an information professional in the current decade.

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The Pandemic Stress Test: Exposing the Cost of Unpreparedness

The COVID-19 pandemic served as an unplanned but revealing stress test of digital readiness in Nigerian LIS education. Aduba and Mayowa-Adebara (2022) documented how LIS students and lecturers in Delta State were forced to improvise digital instruction using mobile messaging platforms with no pedagogical design, no learning management infrastructure, and significant inequities of access. The fact that WhatsApp and Telegram became the de facto Learning Management System of Nigerian LIS education during the pandemic is not evidence of innovation. It is a symptom of a deeper infrastructural and pedagogical crisis, revealing precisely how far behind the curve the system had fallen.

Institutions unprepared for digital learning at baseline found the pivot to fully online instruction nearly impossible to execute with acceptable quality. The result, as documented by Aduba and Mayowa-Adebara (2022), was a teaching-learning experience characterised by network failure, cost barriers, pedagogical limitations, and student disengagement. Digital learning integration is not preparation for a hypothetical future emergency; it is preparation for the ordinary conditions of twenty-first-century educational delivery.

THEORETICAL UNDERPINNINGS: DIGITAL COMPETENCE AS A FOUNDATIONAL PARADIGM

Conceptualising Digital Learning in LIS

Digital learning encompasses any instructional activity that employs digital technologies to deliver, support, or enhance the learning process. In the LIS context, this ranges from the use of online databases and Learning Management Systems to interactive digital tools, virtual reference services, and social media platforms for instructional delivery. Digital learning also involves equipping students with the competencies to navigate, evaluate, organise, and communicate information in digital formats, skills broadly subsumed under digital literacy (Rashid & Asghar, 2016).

The relationship between digital learning and information literacy is particularly significant for LIS. Information literacy, as defined by ACRL (2016), encompasses the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning. This set of abilities is inseparable from digital literacy in the contemporary context. LIS students must develop both simultaneously, and LIS educators must model both in their pedagogical practice.

Theoretical Bridge: Connectivism and TPACK

The theoretical architecture of the Digital Learning Integration Framework for LIS rests on two complementary educational theories: Connectivism and the Technological Pedagogical Content Knowledge (TPACK) model. Connectivism, as articulated by George Siemens (2005), holds that learning in the digital age is distributed across networks of people, technologies, and institutional resources, and that the ability to navigate, curate, and synthesise information across these networks constitutes the essential competency of the contemporary learner and educator. For LIS education, Connectivism translates directly: LIS educators who are not themselves nodes within active digital information networks cannot equip their students to function within such networks. The TPACK framework describes effective technology integration in teaching as the productive intersection of three knowledge domains: technological knowledge, pedagogical knowledge, and content knowledge.

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Applied to LIS teacher education in Colleges of Education, TPACK demands that LIS faculty do not merely possess digital skills in isolation but integrate those skills seamlessly with deep LIS content knowledge and sound instructional design. Emasealu (2022) demonstrated that LIS educators who understood their catalytic role in information literacy education were more deliberate in their instructional design and more effective in producing information-literate graduates, a finding consistent with TPACK's central claim.

Together, Connectivism and TPACK provide the theoretical baseline for the DLIF-LIS, explaining both why digital integration matters at the network level and how it must be operationalised at the classroom level. Rafi, JianMing, and Ahmad (2019) demonstrated that academic libraries integrating digital tools into instructional sessions produced students with significantly higher levels of database navigation ability, online search competence, and digital source evaluation skills, affirming the TPACK-aligned argument that modelling and practice are the mechanisms through which digital competence is transferred.

THE PROPOSED CONCEPTUAL FRAMEWORK FOR DIGITAL LIS TRANSFORMATION (DLIF-LIS)

The Digital Learning Integration Framework for LIS (DLIF-LIS) is a three-node input-process-output model that operationalises the transformation of Nigerian LIS education. The framework maps the causal chain from institutional and curricular decisions through educator behaviour to graduate outcomes, providing LIS departments, accreditation bodies, and policymakers with a structured architecture for planning and evaluating digital integration efforts. Each node is elaborated below.

Input Node: Curricular Revision and Institutional Policy

The input node of the DLIF-LIS is constituted by the structural and regulatory decisions that determine what is taught in LIS programmes. Eze and Aduba (2022) found that only 13 of 30 Nigerian LIS schools offered information literacy as a stand-alone course, and that most departments lacked practical laboratories for hands-on digital skills development. This structural deficiency represents an input-level failure: the raw materials of a digitally competent education are absent before instruction even begins.The input node requires action on two sub-dimensions. The first is curricular design: every component of LIS training, from cataloguing and classification to reference services, collection development, and archival management, has a digital dimension that must be explicitly mapped in course learning outcomes. Digital knowledge and skills must be woven into the entire fabric of LIS education, not treated as an optional specialisation or a single elective course.

The second sub-dimension is infrastructure and regulatory policy: the NUC's Benchmark Minimum Academic Standards for LIS programmes and the LRCN's curriculum guidelines must explicitly mandate digital competency outcomes at each level of LIS education, specifying not merely that students should know about digital technologies but that they should demonstrate measurable competency in using designated categories of digital tools. Okeji and Mayowa-Adebara (2020) documented the gap between what international and national LIS guidelines recommend and what Nigerian programmes deliver; closing this gap requires regulatory will at the NUC and LRCN level.

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Table 1: Complete DLIF-LIS Three-Node Transformation Matrix

Framework Node	**Core Sub-Dimensions**	**Operational Activities & Requirements**	**Key Actors & Drivers**	**Primary Target Outcomes**
INPUT NODE *(Curricular Revision & Institutional Policy)*	**Curricular Design**	•Map digital dimensions explicitly into all course learning outcomes (cataloguing, reference, etc.). •Establish stand-alone Information Literacy courses across all levels.	•LIS Faculty Boards •Curriculum Committees	•Elimination of isolated, elective-only digital training. •Complete integration of digital knowledge into core fabric.
	Infrastructure & Regulatory Policy	•Enforce explicit digital competency mandates at every level. •Build dedicated, functional practical laboratories for hands-on skills development.	•National Universities Commission (NUC - BMAS) •Librarians' Registration Council of Nigeria (LRCN)	•Eradication of structural raw material deficiencies. • Shift from passive theory to active technology demonstration.
PROCESS NODE *(Pedagogical Transition & Educator Behaviour)*	**Instructional Delivery & Methodologies**	•Shift from traditional lecturing to experiential, lab-based digital instruction. •Integrate modern learning management systems (LMS) and collaborative tools into daily teaching.	•LIS Educators / Lecturers •Instructional Designers	• Transformation of educator classroom behaviour. •Active engagement of students in real-world digital problem-solving.
	Capacity Building & Support	•Continuous professional development (CPD) in emerging tech trends. •Institutional tech support and mentoring for faculty members.	•University Management •ICT Directorates	•Enhanced digital self-efficacy among teaching staff. •Standardized, high-quality digital instructional delivery.
OUTPUT NODE *(Graduate Competencies & Systemic Impact)*	**Graduate Marketability & Skills**	•Assessment of graduates against global digital literacy standards. •Production of information professionals skilled in data curation, cloud systems, and automated tools.	•Industry Employers •Academic Examiners	•Workforce-ready graduates matching modern institutional demands. • High employment rates in highly digital information sectors.
	Systemic LIS Transformation	•Continuous curriculum evaluation based on industry feedback loop. •Evolution of Nigerian LIS schools into benchmark digital research centers.	•Accreditation Bodies •LIS Alumni Associations	•Long-term modernization of the Nigerian LIS ecosystem. •Regional leadership in digital information resource management.

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This comprehensive matrix synthesizes the entire Digital Learning Integration Framework for LIS (DLIF-LIS)**,** as shown in Table 1, mapping the complete causal chain from institutional inputs through educator processes to final graduate and systemic outputs.

Process Node: Faculty Technology-Pedagogical Modelling

The process node is where curricular intent is converted into instructional reality, and its driving mechanism is the technology-pedagogical modelling behaviour of LIS faculty. Consistent with the TPACK framework, the DLIF-LIS holds that the critical transformation in LIS education will occur not when curricula are revised on paper but when LIS educators actively demonstrate digital information literacy in their teaching practice.

Emasealu (2022) provided direct evidence for this mechanism, showing that LIS educators who modelled information literacy behaviours, including the use of online databases and digital reference tools, produced students with superior information literacy outcomes. Rashid and Asghar (2016) further demonstrated that technology use in instructional environments had a positive direct effect on self-directed learning and student engagement, and an indirect positive effect on academic performance mediated through those variables. When LIS students are taught in digitally rich environments, they are not only acquiring subject-matter knowledge; they are developing habits of self-directed inquiry and the capacity to navigate complex information systems. These are transferable metacognitive skills that equip LIS graduates to teach digital information skills to others. The process node requires investment in faculty professional development. Sambo, Imran, and Akanbi (2022) found that the majority of Nigerian certified librarians fund their own professional development individually rather than through institutional support, demonstrating how severely this area has been neglected. COEASU should push for dedicated TETFUND windows for LIS faculty digital capacity building, structured partnerships with international LIS schools for short-term digital skills training, and peer communities of practice where LIS educators share digital teaching innovations.

Output Node: The Digitally Competent Information Professional

The output node of the DLIF-LIS is the digitally competent LIS graduate: a professional equipped to locate, organise, preserve, disseminate, and teach with information in environments that are overwhelmingly digital. The graduate produced by a DLIF-LIS-aligned programme demonstrates competency in major bibliographic databases and digital library platforms, the design and delivery of digital information literacy instruction, the use of e-learning tools for virtual reference, digital cataloguing, and online community outreach, and the capacity to model information literacy behaviours for the communities they serve. Adekoya (2022) found that information literacy played a significant role in advancing institutional sustainability and that the extent of information use among academic staff was high, demonstrating that producing information-literate LIS professionals is not merely a disciplinary goal but contributes directly to the broader effectiveness of Nigerian higher education. Mole, Dim, and Horsfall (2017) argued that the mismatch between the technical competencies of LIS graduates and employer expectations constitutes a structural failure with economic implications for graduates and service implications for employing institutions. The output node of the DLIF-LIS addresses this mismatch directly by defining graduate competency standards that correspond to professional

expectations rather than institutional convenience.

Framework Dynamics: How the Nodes Interact

The DLIF-LIS is not a linear progression but a dynamic system in which the three nodes interact and mutually reinforce one another. Institutional policy revisions at the input node create the regulatory and structural conditions for faculty to teach differently. Faculty modelling at the process node, in turn, generates evidence of what graduate outcomes are achievable, which can feed back into further curriculum revision. Graduate competency at the output node builds the professional community's expectations of what LIS education should produce, sustaining pressure for continued reform at the input level.

This dynamic also means that partial implementation produces weakened outcomes. A curriculum that mandates digital learning outcomes but does not invest in faculty digital capacity will produce graduates who know about digital tools but cannot use them, precisely the outcome Okeji and Mayowa-Adebara (2020) documented. A faculty with strong personal digital skills but no curricular mandate to integrate them will produce inconsistent digital learning experiences dependent on individual initiative. Only the alignment of all three nodes produces graduates systematically equipped for digital information practice.

CRITICAL DIALECTIC: ADDRESSING COUNTERARGUMENTS

Counterargument: Infrastructure Deficits Make Digital Integration Impractical

The most frequently encountered rebuttal to the position advanced in this paper holds that digital learning integration is aspirational rhetoric in the context of Nigeria's documented infrastructure deficits: erratic power supply, inadequate internet connectivity, and the absence of functional computer laboratories (Abubakar, 2021). This counterargument has practical resonance, but it ultimately harms the very students it claims to protect.

Infrastructure deficits are an argument for creative solutions and sustained advocacy, not for accepting the status quo. Institutions in far more constrained environments than Nigerian universities have found workable approaches through offline-capable digital tools, mobile-first learning design, low-bandwidth platforms, and blended asynchronous frameworks. More critically, waiting for perfect infrastructure conditions creates permanent academic regression, consigning LIS graduates to an education that will not prepare them for professional contexts where digital competence is already expected. The appropriate response is to address infrastructure challenges at the policy and institutional level through TETFUND allocations, private sector partnerships, and open educational resource frameworks, while simultaneously implementing contextually adapted digital instruction with available resources.

Counterargument: Traditional LIS Competencies Should Not Be Displaced

A second counterargument holds that emphasis on digital integration threatens to marginalise enduring LIS competencies such as classification theory, archival principles, and reference service philosophy. This concern rests on a false opposition. The position advanced in this paper does not call for replacing foundational LIS competencies with digital tools but for applying those competencies in digital environments. Cataloguing in a digital library context still requires deep understanding of bibliographic principles; digital reference service still demands sophisticated knowledge of information sources and user needs. Digital integration

enriches traditional LIS competencies; it does not replace them.

Counterargument: Faculty Lack the Skills to Deliver Digital LIS Instruction

A third counterargument is practical: many LIS faculty members in Nigerian Colleges of Education and universities do not themselves possess the digital competencies required to deliver digitally integrated instruction. This is documented across multiple studies of the Nigerian LIS landscape. It is, however, an argument for urgent investment in faculty professional development, not an argument for maintaining pre-digital curricula indefinitely. Professional associations, university libraries, and international partner institutions can all serve as resources for this development. The NLA and COEASU, as the primary professional and academic organisations for Nigerian LIS educators, are uniquely positioned to coordinate national digital capacity-building initiatives. The process node of the DLIF-LIS is specifically designed to address this gap.

STRATEGIC IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSION

Implications for LIS Teacher Education in Colleges of Education

Colleges of Education hold a specific and strategic position in this argument. Their mandate is to produce teachers who will deliver basic and post-basic education across the country. LIS educators trained in Colleges of Education will work not only in libraries but also in schools, where they will shape the information literacy habits of children and young people at their most formative stages. The consequences of inadequate digital preparation in College of Education LIS programmes therefore extend far beyond the library profession.

Concretely, LIS teacher education programmes should include as non-negotiable curriculum components: practical instruction in major bibliographic databases and digital library platforms; the design and delivery of digital information literacy instruction sessions; the use of e-learning tools for virtual reference, digital cataloguing, and online community outreach; and a reflective practicum component in which student teachers are assessed on their ability to teach digital information skills at the appropriate level. Adekoya (2022) has shown that information literacy contributes to the sustainable development of higher education institutions; Colleges of Education that produce digitally capable LIS teachers are therefore advancing a contribution that extends well beyond individual departments.

Actionable Recommendations

To the NUC and the LRCN: Initiate a focused review of the LIS Benchmark Minimum Academic Standards to explicitly incorporate digital competency outcomes at every degree level. The revised benchmark should specify minimum digital infrastructure requirements, required practical digital skills, and assessable digital literacy learning outcomes that all NUC-accredited LIS programmes must meet as a condition of continued accreditation.

To COEASU and the NLA: Jointly develop and implement a national digital capacity-building programme for LIS faculty in Colleges of Education and universities, combining online modules, short-term residency at institutions with advanced digital LIS facilities, and peer-learning networks. Digital competency should be incorporated into the NLA's continuing professional development requirements and into LRCN registration renewal criteria.

To TETFund: Create a targeted intervention fund for digital LIS

infrastructure development, with specific provisions for compsuter laboratory equipment, broadband connectivity, licensed database subscriptions, and LMS deployment. Applications should require demonstration of a digital curriculum integration plan, aligned with the DLIF-LIS input node, as a condition of approval.

To Heads of LIS Departments: Conduct immediate curriculum audits to identify the proportion of courses currently incorporating digital learning objectives and practical digital activities. Use audit findings to develop a three-year digital integration roadmap with specific annual milestones benchmarked against the three nodes of the DLIF-LIS, and share the roadmap with faculty, students, and accreditation bodies to create accountability.

To LIS Faculty Members: Invest in personal digital professional development through open online courses, international webinars, and national workshops on digital LIS tools and pedagogies. Adopt digital open educational resources in course delivery and model the information literacy behaviours you seek to cultivate in students, consistent with the process node demands of the DLIF-LIS.

To Provosts of Colleges of Education: Prioritise LIS digital infrastructure development in institutional capital plans and TETFUND budget submissions. Facilitate partnerships with neighbouring universities, public libraries with digital resources, and private sector organisations to extend digital learning resources available to LIS students and faculty. Include demonstrated digital teaching competency in promotion and appointment criteria for LIS lecturers.

Conclusion

This paper has introduced and elaborated the Digital Learning Integration Framework for LIS (DLIF-LIS), a conceptual model grounded in Connectivism and TPACK that maps the transformation of Nigerian LIS education across three interdependent nodes: curricular revision, faculty technology-pedagogical modelling, and the production of digitally competent information professionals. The framework provides LIS educators, institutional administrators, and accreditation bodies with a structured, implementable architecture for driving digital transformation in a sector where the cost of continued inaction is well documented.

LIS as a discipline has been reshaped by the digital revolution. The professionals it trains are expected to be navigators, curators, educators, and advocates in an information environment that is overwhelmingly digital. Nigerian LIS programmes that continue to deliver predominantly print-centric, non-digital instruction are producing graduates for a profession that no longer works the way those graduates have been trained. This is not fair to the graduates, to the communities they will serve, or to the profession itself.

LIS is one of the most strategically positioned disciplines for driving digital transformation across the educational system. LIS educators train the professionals who will train everyone else in information skills. If that chain begins with digital competence anchored in a rigorous framework, it multiplies digital capability across society. If it begins with analogue preparation, it multiplies that limitation instead. The DLIF-LIS offers a pathway out of that limitation. The choice to act on it belongs to the faculty, administrators, policymakers, and professional associations who must now respond with the urgency this moment demands.

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