UTILIZATION OF ARTIFICIAL INTELLIGENCE IN LIBRARY AND INFORMATION SERVICES FOR EFFECTIVE TEACHING, LEARNING AND RESEARCH IN ACADEMIC LIBRARIES

[1]Ejila, Irene O. (CLN), [2]KAJANG, Victor S. (CLN) & [3]AMINU, Hajara M.

[1]Library and Information Services Department
Nigerian Institute of Leather Science and Technology, Samaru-Zaria, Nigeria
Email: zaradinikf@gmail.com /+2347030538202

[2]Library and Information Services Department
National Research Institute for Chemical Technology,
Basawa-Zaria, Nigeria
Email: kajhvictor73@gmail.com /+2348167248379

[3]Library and Information Services Department
Nuhu Bamalli Polytechnic, Zaria, Kaduna State, Nigeria
Email: hajaraaminu1972@gmail.com /+2348065297163

Abstract

Artificial Intelligence (AI) is revolutionizing Library and Information Services (LIS), offering transformative potential for effective teaching, learning, and research. This abstract explores the integration of AI technologies in LIS, highlighting their impact on the academic ecosystem. AI-driven tools such as intelligent search engines, chatbots, recommendation systems, and automated indexing are enhancing the discoverability and accessibility of educational and scholarly resources. These tools support personalized learning experiences, streamline administrative tasks, and enable data-driven decision-making for educators and researchers. Libraries are evolving into smart learning environments, where AI facilitates real-time assistance, predictive analytics for user behavior, and advanced content curation. Furthermore, AI empowers research through semantic search capabilities, citation analysis, and automated summarization of large datasets. The paper also addresses challenges such as data privacy, ethical concerns, and the need for digital literacy among library professionals. It concludes that there is need for institutional librarians to engage their institutional management to intensify strategies of building collaboration and partnerships with policy makers, philanthropists, stakeholders, non-governmental organisations and international organisations to source for grants for integration and implementation of Artificial Intelligence technology in Academic Libraries for fostering innovation, improving users' engagement and significantly contributing to the advancement of educational and scholarly communication.

Keywords: Academic Libraries, Artificial Intelligence, Information Services, Library, Teaching, Learning and Research

Introduction

In the rapidly evolving digital age, artificial intelligence (AI) has emerged as a transformative force across various sectors, including education, research, and library and information services. Libraries, once solely custodians of physical materials, are now at the forefront of digital transformation, leveraging AI technologies to enhance information retrieval, streamline knowledge organization, and support academic excellence. AI-driven systems such as intelligent search engines, conversational chatbots, recommendation algorithms, automated indexing and classification tools, and research analytics platforms are fundamentally reshaping how information is accessed, managed, and utilized in academic environments (Wu, 2015).

The integration of AI in library and information services directly contributes to more effective teaching, learning, and research processes. Intelligent search engines utilize Natural Language Processing (NLP) and machine learning to improve search accuracy and relevance, enabling students and researchers to access critical resources more efficiently (Bawack *et al.*, 2021). Chatbots, equipped with AI capabilities, provide 24/7 user assistance, guiding users through complex databases and library catalogs, thus enhancing user experience and reducing the workload on library personnel (Lau *et al.*, 2019). Furthermore, AI-powered recommendation systems personalize content delivery, suggesting books, articles, and resources based on user behavior and preferences, thereby fostering deeper engagement with scholarly materials (Beel *et al.*, 2016).

Automated indexing and classification systems have revolutionized the way academic resources are organized and retrieved. These systems not only accelerate metadata generation but also improve the accuracy and consistency of resource categorization, enhancing discoverability across digital libraries (Singh & Kumar, 2020). In the context of scholarly resources and research analytics, AI tools offer sophisticated data mining and visualization capabilities, supporting bibliometric analysis, citation tracking, and trend identification. This enables researchers and educators to make data-driven decisions, monitor research impact, and identify emerging fields of inquiry (Tsai *et al.*, 2020).

The implementation of AI technologies in library and information services aligns with the increasing demand for digital literacy, open access, and personalized learning experiences. As educational institutions transition toward smart learning environments, libraries play a critical role in ensuring seamless access to information and promoting a culture of inquiry and innovation (Bawock *et al.*, 2021). Therefore, the adoption and integration of Artificial Intelligence (AI) in libraries will allow for better information processing, and at the same time, better information search that will excite both library personnel and users since there will be easier and faster access to information for teaching, learning and research.

Artificial Intelligence (AI) refers to the branch of computer science that is concerned with building systems capable of performing tasks that normally require human intelligence. These tasks include reasoning, learning from experience, understanding natural language, recognizing patterns, and making decisions (Russell & Norvig, 2021). AI is categorized into two broad types: narrow AI, which is designed for a specific task (e.g., voice assistants like Siri or image recognition software), and general AI, which aims to replicate the broad cognitive abilities of a human being. AI systems typically rely on algorithms and models that enable machines to simulate aspects of human intelligence. A key component of modern AI is machine learning (ML), a subset of AI that focuses on developing algorithms that allow computers to learn from and make predictions or decisions based on data (Goodfellow, Bengio, & Courville, 2016). Deep learning, a specialized form of ML using neural networks with many layers, has advanced capabilities in fields like speech recognition and computer vision.

Library and Information Services (LIS) refer to the organized provision of access to information resources, including printed materials, digital content, and various information tools and technologies. These services are essential for facilitating learning, teaching, research, and informed decision-making in diverse environments such as academic institutions, public libraries, corporate organizations, and government agencies IFLA, 2019). According to the International Federation of Library Associations and Institutions (IFLA), Library and Information Services (LIS) are "designed to meet the information, educational, cultural, and recreational needs of users by ensuring equitable access to knowledge" (IFLA, 2019). Library and Information Services (LIS) play a critical role in ensuring equitable access to knowledge, supporting lifelong learning, promoting digital inclusion, and fostering innovation. They empower communities, support research and scholarship, and uphold the freedom of information.

Academic libraries are specialised information institutions that support the teaching, learning and research activities of higher educational institutions such as universities, polytechnics, colleges and research institutes. Their primary role is to collect, organise, preserve, and provide access to scholarly information resources in various formats, being it print, digital, and multimedia, to meet the academic and research needs of students, faculties and researchers (Afolabi, 2020). The academic libraries play a critical role in formation literacy instruction, helping users to develop skills to locate, evaluate, and ethically use information (Owusu-Ansah, 2015). To remain relevant, the academic libraries must continually innovate by integrating digital tools, promoting open access initiatives, and aligning their services with institutional goals (Tenopir, et al., 2019).

Thus, the study Utilisation of Artificial Intelligence (AI) in Library and Information Services for Effective Teaching, Learning, and Research in Academic Libraries required to reveal how Artifice Intelligence has become a transformative force in modern library operations, services and academic support, the integration of Artificial Intelligence (AI) into library and information services enhances the teaching and learning process by enabling personalised learning experiences, facilitating quick access to relevant academic resources, and also assist librarians in managing large volumes of data, automating repetitive tasks, and making data-driven decision that improve service delivery and resource utilisation.

Literature Review

The concept of Artificial Intelligence (AI) in the context of library and information services refers to a variety of technologies such as machine learning, natural language proceeding, robotics, chatbots, recommendation systems, big data analytics and smart systems that can enhance library operations and support user services. Marasinghe, Gunasekera & Senevirathne (2024) conducted a systematic literature review and found that AI's potential in libraries includes automating many operations and providing 24/7 assistance to library users. In the academic library context, AI offers possibilities to enhance teaching, learning and research by improving resource discovery, customizing user-experience, automating routine tasks, and enabling data-driven decision-making.

Studies show that academic libraries are increasingly adopting AI technologies to streamline operations. For instance, Akinola (2023) discusses tools such as natural language recognition, robotics, big data and machine learning in Nigerian academic libraries, noting that AI can revolutionize library services and enhance productivity. In a study of African University libraries, Abba reports that few libraries have adopted AI technologies such as chatbots, robots, RFID, and systems like LibKey, being used in directional and ready-reference questions, self-checkout, marketing, cataloguing, statistics and recommendations. Mandal (2024) also reviewed applications an impact of AI in academic libraries, finding advantages such as increased effectiveness, better accessibility and customized user experiences.

Although many studies focus on library operations, there is growing literature on how AI supports teaching, learning and research. For example, Steiger's literature review discusses how AI can assist students and librarians, but also raises concerns (e.g. plagiarism, misinformation) that impact higher-education and academic libraries. Thus, AI's role in academic libraries extends to influencing how teaching and research are supported-through smarter discovery tools, recommending resources, tailoring services to researcher/learner needs, and managing large-data/information flows. Lack of librarian expertise in AI, absence of policy frameworks, and low awareness of AI's potential. Igbo et al. (2024) discusses prerequisites such as digital infrastructure, skilled staff, policy and data for training. Suleimn, Akanbi & Ibidunni (2024) highlight issues of data privacy, algorithmic bias, unequal access to AI-driven services in Nigerian university libraries. Zondi et al (2024) in South Africa note that success of AI implementation depends on planning, collaboration, funding and promotion, and that librarians' attitudes vary.

May studies focus on operations (cataloguing, circulating, reference) rather than linking AI utilization directly to teaching and learning outcomes or research productivity. For example, the systematic review by Marasinghe et al. argues that while many services are identified, deeper studies on AI for personalized learning and participatory library services are lacking. Empirical evidence on how AI-enabled library services improve student learning outcomes or support faculty research is research is relatively scarce. Contextual studies in developing countries (Africa, Asia) are fewer, especially exploring how local constraints affect teaching, learning and research support via AI.

Ethical, equity, access and diversity issues specific to AI in libraries supporting academic research, learning are under-explored. For example, the work by Berendit et al. (2023) on bias and fairness in AI in libraries suggests broader issues, though not always specific to academic-library teaching and learning contexts. Longitudinal and comparative studies across institutions, or linking AI utilization in libraries to measurable research metrics (publication output, citation, user satisfaction, learning retention) are limited.
The literature shows that AI has substantial potential to transform library and information services in academic settings, and by extension to support teaching, learning and research. However, many libraries (especially in developing countries) are still at early stages of adoption. Key challenges persist, externally (funding, infrastructure) and internally (skills, policy, culture).

Utilization of Artificial Intelligence in Library and Information Services for Effective Teaching, Learning and Research in Academic Libraries

The integration of Artificial Intelligence (AI) in Library and Information Services (LIS) is transforming traditional academic support systems into intelligence platforms that enhance teaching, learning, and research. Technological such as intelligent search engines, AI-power chatbots, recommendation systems, automated indexing, and the management of scholarly resources are reshaping hos users interact with information (Tanzi, 2023). These technologies promise not only improved efficiency but also personalization and contextual relevance in academic environments as follows:

i. Intelligent Search Engines

AI-driven search engines enhance information retrieval by understanding natural language queries, analyzing context, and ranking results based on relevance. Unlike traditional keyword-based systems, AI systems leverage machine learning and semantic analysis to improve the precision and recall of search results. Semantic Scholar and Google Scholar use AI to understand the context of academic queries, highlighting influential citations and summarizing research findings (Ammar *et al.*, 2018). These tools facilitate deeper research exploration, particularly beneficial for students and scholars who need to navigate vast volumes of scholarly content.

ii. Chatbots in Libraries

AI-powered chatbots provide 24/7 assistance to library users by answering queries, guiding searches, and supporting resource discovery. These systems use Natural Language Processing (NLP) to stimulate human-like conversation. The University of Pretoria implemented a chatbot to assist students with library services, achieving increased engagement and accessibility (Both *et al.*, 2020). It enhances user support services, particularly for distance learning and during off-hours.

iii. AI-Powered Recommendation Systems

Recommendation systems in academic libraries suggest books, articles, and databases based on user behavior, preferences, and scholarly trends. These systems apply collaborative filtering, content-based filtering, and deep learning algorithms. AI in platforms like Mendeley and Zotero offers research recommendations based on user libraries and citation behavior. Improves user discovery of relevant materials, supports curriculum development, and aids in interdisciplinary research. (Lu & Zhang, 2019).

iv. Automated-Indexing and Classification

AI tools can automate the cataloging of resources by extracting metadata, keywords, and subject classifications using NLP and deep learning techniques. OCLC’s WorldCat uses machine learning algorithms to auto-classify and enrich bibliographic records. Reduces the workload of catalogers, speeds up the processing of new materials, and enhances the consistency of metadata (Wang & Zhang, 2021).

v. Scholarly Recourses and Research Analytics

AI helps manage scholarly resources through predictive analytics, citation analysis, plagiarism detection, and trend forecasting. Tools like Scopus and Dimensions use AI to track research impact and map scholarly networks. Supports institutional research strategies, publication planning, and academic performance assessment (Thelwall & Wilson, 2016).

Challenges

Despite these advancements, the integration of Artificial Intelligence in Library and Information Services also presents challenges such as:

i. Infrastructure and Technological Limitations

In many regions, particularly in developing countries, inadequate infrastructure hampers the effective deployment of AI in libraries. Challenges such as unstable power supply, limited internet connectivity, and outdated hardware impede the seamless integration of AI technologies. For instance, studies have highlighted that insufficient ICT infrastructure in Nigerian university libraries limits the adoption of AI tools, affecting service delivery and user satisfaction (Ajani, 2022).

ii. Financial Constraints

Implementing AI solutions requires significant financial investment in both hardware and software. Many libraries, especially in resource-constrained settings, struggle to allocate funds for such technologies. The high costs associated with AI systems, including licensing fees, maintenance, and staff training, pose substantial barriers to adoption (Ali *et al.*, 2020).

iii. Skill Gaps and Training Deficiencies

The successful integration of AI in LIS necessitates a workforce equipped with the requisite skills. However, there is often a lack of adequate training programs for library staff. Research indicates that many librarians have not received formal training in AI technologies, leading to underutilization of available tools and resistance to adopting new systems Hervieux & Wheattey, 2021).

iv. Ethical and Privacy Concerns

The use of AI in libraries raises significant ethical issues, particularly concerning data privacy and security. Libraries collect vast amounts of personal data from users, and the deployment of AI systems must ensure compliance with data protection regulations. There is a need for clear policies and guidelines to address these concerns and maintain user trust (Ajani, 2022).

v. Resistance to Change

Cultural and organizational resistance to adopting AI technologies can impede progress. Some library staff may perceive AI as a threat to their roles or may be hesitant to embrace new technologies due to unfamiliarity or fear of obsolescence. Overcoming this resistance requires leadership, clear communication, and involvement of staff in the change process (Echedom & Okuonghae, 2021).

vi. Impact on Teaching and Learning

While AI has the potential to personalize learning and provide tailored resources, its misuse can lead to issues such as academic dishonesty. The ease of generating content using AI tools may encourage students to bypass critical thinking and original work, undermining the educational process. Educators must find a balance between leveraging AI for enhancement and maintaining academic integrity (Imoisili, 2023).

Conclusion

The integration of Artificial Intelligence (AI) into library and information services has significantly transformed the landscape of teaching, learning and research in academic libraries holds great promise for redefining the roles of libraries in higher education. As academic institutions and research environments become increasingly digital and data-driven, AI tools have emerged as powerful enablers that enhance access to information, streamline knowledge discovery, and personalize educational experiences. By embracing IA-driven innovations, academic libraries can evolve into intelligent knowledge hub that not only support but also enrich teaching, learning and research activities in the digital age.

Sustainability investment, policy development, and capacity building are essential for maximizing the benefits of Artificial Intelligence (AI) and ensuring its long-term impact on academic excellence and information service delivery. Therefore, there is the need institutional librarians to engage their institutional management to intensify strategies of building collaboration and partnerships with policy makers, philanthropies, stakeholders, non-governmental organizations and international organizations to source for grants for integration and implementation of Artificial Intelligence technologies in academic libraries in fostering innovation, improving users engagement, and significantly contributing to the advancement of education and scholarly communication.

Way Forward

i. **Adequate Institutional Management Support:**

Institutional Management should provide adequate support to libraries to meet up with their aims and objectives in attaining the mission of the parent institution for the sustainability of teaching, learning and research.

ii. Adequate Funding of Libraries:

The institutional management should provide adequate capital in funding the library facilities especially the recommended UNESCO requirement of providing 15% true of the institute budget to the library so that the library will meet up with its responsibilities in providing the required facilities and providing effective library and information services.

iii. Adequate Technological Facilities:

There is the need for management to provide adequate technological facilities for the libraries to enable them upgrade with the current trends and provide competitive high-speed internet and computing resources and integration platforms with compatible Artificial Intelligence tools.

iv. Collaboration and Partnerships:

There is the need for Academic Library Management to collaborate and partner with other Academic institutions libraries, technological firms for co-developing AI solutions and share AI resources and digital library networking to explore AI impact with best practices and expertise.

v. Building Capacity and Digital Library:

There is the need for regular training of librarians and library officers on digital literacy and Artificial Intelligence tools to have more knowledge and digital skills on algorithms and ethical handling of Ai system in providing library and information services.

vi. Regular Power Supply:

It is expected that in any functional library to operate effectively, there is the need to have regular power supply especially with the current trend of information and communication technologies, internet connectivity, digital libraries and Artificial Intelligence. To this effect, Academic libraries are expected to provide alternative power supply to meet the information needs of their users.

vii. Monitoring, Evaluation and Reporting:

The essence of monitoring, evaluation and reporting is to provide quality control and maintenance of the libraries and its facilities to avoid breakdown and enhance the maintenance of these facilities so that they can be in good condition. To this extent, there is the need to set up a monitoring framework to evaluate the impact of these facilities.

References

Ajani, A. (2022). Use of Artificial Intelligence in the Library Services: Prospects and Challenges. Academia.edu. Retrieved from https://www.academia.edu/96822733 May, 2025.

Afolabi, M. (2020). *Library and Information Science in Higher Education*. Ibadan: University Press.

Akinola, S.A. (2023). Capabilities and Apparent implications of Artificial Intelligence (AI) Adoption in Nigerian Academic Libraries. *University Library at a New Stage of Social Communities Development*, (8), 283-289.

Ali, S., *et al.* (2020). Investigating Applications of Artificial Intelligence in University Libraries of Pakistan: An empirical study. ScienceDirect. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0099133323001428

Ammar, W., Groeneveld, D., Bhagavatula, C., Beltagy, I., Crawford, M., Downey, D., … & Lo, K. (2018). Construction of the Literature Graph in Semantic Scholar. *NAACL-HLT*, 84-91.

Bawack, R. E., Wamba, S. F., & Carillo, K. D. A. (2021). "Artificial Intelligence in Practice: Implications for Information Systems Research." *Journal of Enterprise Information Management*, 34(6), 1805–1827. https://doi.org/10.1108/JEIM-01-2020-0015

Bawack, R.E., Wamba, S.F. & Carilo, K.D.A (2021). "Artificial Intelligence in Practice: Implications for Information Systems Research." *Journal of Enterprise Information Management*, 34(6), 1805-1827. https://doi.org/10.1108/JEIM-01-2020-0015

Beel, J., Gipp, B., Langer, S., & Breitinger, C. (2016). "Research-paper Recommender Systems: A Literature Survey." *International Journal on Digital Libraries*, 17(4), 305–338. https://doi.org/10.1007/s00799-015-0156-0

Berendt, B., Karadeniz, O., Kiyak, S., Mertens, S., & d'Haenens, L. (2023). Bas, Diversity, and Challenges of Fairness in Classification and Automated Text Analysis. From Libraries to AI and Back.

Botha, G., Herselman, M. & Ramnund-Mansingh, A. (2020). "Implementation of a Library Chatbot to Support Teaching and Learning." *South African Journal of Information Management*, 22(1), 1-8.

Echedom, A., & Okuonghae, R. (2021). "A Review of Artificial Intelligence Implementation in Academic Library Services." *South African Journal of Libraries and Information Science*, 90(2), 2399. Retrieved from https://journals.co.za/doi/full/10.7553/90-2-2399

Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. MIT Press.

Hervieux, C., & Wheatley, R. (2021). LIS Educators' Perception Towards the Adoption of AI Tools in Nigerian Library Schools. Metaverse Basic and Applied Research. Retrieved from https://mr.ageditor.ar/index.php/mr/article/view/52

IFLA. (2019). IFLA Library Services Guidelines. Retrieved from https://www.ifla.org/ May, 2025

Igbo, H.U., Imo, N.T., Jidere, U.J. & Ugwu, F.N. (2024). Adopting Artificial Intelligence IN Academic Library Services in Nigeria: Requirements and challenges. NigerBiblios: *Journal of National Library of Nigeria*, 34(1), 1-18.

Imoisili, O.O. (2023). "Exploring the Awareness, Use and Challenges Facing the Integration of Artificial Intelligence in Library Services by Librarians in University Libraries in North-Central Nigeria." *Journal of Librarianship and Information Science*.

Lau, J. H., Baldwin, T., & Cohn, T. (2019). "Deep Learning for Chatbots in Libraries: An Overview." *Journal of Information Science*, 45(4), 558–571. https://doi.org/10.1177/0165551518809395

Lu, Y., & Zhang, P. (2019). “Recommendation Systems in Academic Libraries: A Survey.” *Journal of Information Science*, 45(3), 345-357.

Mandal, M. (2024). Artificial Intelligence in Academic Libraries: Applications and Impact Review. *International Journal of Innovations in Science, Engineering and Management*, 3(4), 01-09.

Marasinghe, M.M.I.K., Gunasekera, D., & Senevirathne., W.A.R. (2024). Application of Artificial Intelligence for Library Services: A Systematic Literature Review. *Journal of the University Libraries Association of Sri Lanka*, 27(2), 257-284.

Russell, S., & Norvig, P. (2021). Artificial Intelligence: A Modern Approach (4th ed.). Pearson.

Singh, S., & Kumar, A. (2020). “Intelligent Classification and Indexing Using Machine Learning in Digital Libraries.” *Library Hi Tech*, 38(3), 541–556. https://doi.org/10.1108/LHT-11-2019-0224

Steiger, K. (2025). Artificial Intelligence in Higher Education and Academic Libraries: A Literature Review. Endnotes: *The Journal of the New Members Round Table*.

Suleiman, Y., Akanbi, I.M. & Ibidunni, S.A. (2024). Leveraging Artificial Intelligence (AI) for Library Services in Nigerian Universities: Ethical Consideration and Potential Benefits. *International Journal of Intellectual Discourse*, 7(4).

Tanzi, N. (2023). Applied AI in Library and Information Science (LIS) 2023. ChatGPT Librarian. Retrieved from: https://www.chatgptlibrarian.com/2023/11/applied-ai May, 2025.

Thelwall, M., & Wilson, P. (2016). “Mendeley Altmetrics for Medical Articles: An Analysis of 45 Fields.” *Journal of the Association for Information Science and Technology*, 67(8), 1962-1972

Tsai, C. W., Poquet, O., Gašević, D., Dawson, S., & Pardo, A. (2020). “Complexity Leadership in Learning Analytics: Drivers, Challenges and Opportunities.” *British Journal of Educational Technology*, 51(3), 777–793. https://doi.org/10.1111/bjet.12846

Wang, P. & Zhang, X. (2021). “Automation in Subject Indexing: Trends and Challenges.” *Cataloging & Classification Quarterly*, 59(5), 481-497.

Wu, C. *et al.*, (2015). Enhanced Services of Next-Gen Libraries Through Artificial Intelligence: In Library and Information Science. IGI Global 347-643.

Zondi, N., Epizitone, A., Nkomo, N., Mthalane, P.P., Poyane, S., Luthuli, M., Khumalo, M., & Phokoye. S. (2024). A Review of Artificial Intelligence Implementation in Academic Library Services. *South African Journal of Libraries and Information Science*, 90(2).