
Bridging the Digital Divide in Academic Libraries: Artificial Intelligence Adoption for Information Access and User Services — a Literature Review

**ASNAWI C. EDRIS
MA. FELAMIE G GALO
KIARA KEREN R. MERCADO-ALAVANZA
RAHIEMA M. SIGAYAN
JUNEVIE M. VILLA
ERMA S. AMBALONG**

Saint Columban College, 0362, Vicencio Sagun St, Pagadian City, Philippines

Abstract — Many academic libraries are starting to use artificial intelligence (AI) to increase information accessibility, improve service to users, and enhance their ability to provide services, but how AI can help address technology-related disparities remains an open question. In this review, the researchers examined current studies on how AI is applied in academic libraries, how the adoption of AI could promote accessibility, inclusive access to information, and user experience, and the introduction of new risks and disparities. A structured literature review was conducted to collect data by searching for and reviewing literature related to the adoption of AI in academic libraries. The literature meeting the inclusion criteria was analyzed for themes, and three themes emerged: the use of AI in academic libraries, the relationship between AI and the digital divide, and considerations and challenges in adopting AI. The main factors driving the adoption of AI in academic libraries are improved operational efficiency, improved discovery systems, and improved support for library customers. Machine learning is typically used for metadata enhancement, more intelligent information retrieval, and more personalized information delivery. AI is also used by academic libraries through automation tools that perform services previously handled by library staff, via library management systems, and through infrastructure tools such as computer network security. Although AI has the potential to improve digital inclusion through better remote access, greater access to services, and improved user experience, its effectiveness in this area is constrained by the lack of appropriate infrastructure and funding, as well as the ethical challenges of AI, such as bias, privacy, and the lack of transparency. Researchers concluded that

AI has the potential to improve information access and user services in academic libraries, and could help decrease the barriers to digital divide access to information through improved intelligent discovery, improved automation, and improved accessibility.

Keywords: Artificial Intelligence; Academic Library; Digital Divide; Information Access; User Experience; Ethical Governance

I. INTRODUCTION

Academic libraries have undergone significant changes as they become more digital service centers providing fast, inclusive and dependable access to scholarly resources (Williams, 2023). However, this evolution has not benefitted all equally. There is still a "digital divide" that impacts access to technology, connectivity, basic digital capabilities (i.e., digital literacy) and usable online resources. In addition to being about physical access to devices and the internet, scholars are stressing the importance of "second-level" divides (related to skills or capabilities) and "third-level" divides (disparities resulting from digital participation) (Lythreath et al., 2022). Divides in academic environments have significant consequences for learning opportunities, productivity of research and equity in education.

In addition, artificial intelligence (AI) has become one of the most significant technological advancements in the field of information services today. Academic libraries are starting to use AI-driven technologies that improve both discovery systems and user support. These technologies include recommender systems, semantic search technology, chatbots, automated metadata generation, machine translation, and predictive analytics (Kulkanjanapiban et al., 2025). Additionally, the increasing prominence of conversational agents (chatbots) and large language models (LLM) has brought new attention to using AI as an effective way of supporting reference services and providing more intuitive and accessible searches for users who otherwise may have difficulty using traditional search interfaces (Khan et al., 2024). All of this evidence demonstrates that AI could be a solution for many of the long-standing accessibility barriers libraries have faced,

but it also raises serious concerns about whether or how AI will reproduce or exacerbate existing inequalities.

This literature review is situated at the intersection of two active research areas: digital inequality and AI adoption in academic libraries. Research on technology adoption in libraries has frequently drawn on models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), which emphasize factors like perceived usefulness, ease of use, organizational readiness, and social influence (Rafique et al., 2020; Xue et al., 2024).

A major area of contention in the academic field is the disparity of viewpoints about how AI will facilitate equity in digital literacy. An emerging perspective is that AI technologies, such as automated reference tools (e.g., chatbots) and natural language interfaces, can facilitate democratic access to resources and services by providing assistance to multilingual users, increasing the accessibility of information for differently abled citizens, and creating 24/7 assistance through chatbots and automated reference service tools.

For instance, through AI-supported natural language interfaces, novice users will find it easier to access resources via natural language search rather than keyword search, while automated translation services will reduce the language barrier for users seeking information (Ikwuanusi et al., 2023). Alternatively, some critics maintain that AI systems serve to further widen gaps in digital equity because their training data is filled with bias; that their use reinforces discriminatory patterns; and that they tend to operate as "black boxes," which makes it difficult to fully audit and/or explain how a user or librarian can be confident with respect to what information was used to develop an AI system (Pawar, 2024). The present study reviews the literature in order to examine how academic libraries are currently implementing AI technologies for improving access to information and user services, as well as how the related issues of digital equity informed the transition to technology by academic libraries in order to bridge the digital divide. The purpose of this literature review is to summarize existing research, identify major patterns and theorist approaches to developing the current literature base, and identify deficiencies in that body of research that needs additional study. In total, by connecting critical pieces of literature regarding

the digital divide and AI adoption within academic libraries, this review seeks to improve the reader's understanding of the relevance of AI systems to increase users' access and/or improve users' services in academic libraries in addition to identifying associated risks and limitations. Ultimately, the primary objective of the literature review is to improve the reader's understanding of AI adoption with academic libraries and that the adoption may serve as both an opportunity and challenge to develop access in an equitable way.

II. METHODOLOGY

This study employed a systematic literature review (SLR) to synthesize scholarly evidence on the adoption of artificial intelligence (AI) in academic libraries, with particular emphasis on AI applications for information access and user services and their implications for bridging the digital divide. A systematic approach was used to ensure transparency and replicability in identifying, selecting, and analyzing studies relevant to academic library contexts. The review was guided by a set of research questions aligned with the synthesis's thematic structure. These questions focused on (1) *Artificial Intelligence (AI) applications in Academic Libraries*, (2) *Artificial Intelligence and the Digital Divide in Academic Libraries*, and (3) *the Challenges and Considerations in AI Adoption in Academic Libraries*.

Studies from major scholarly databases on library and information science, education and computing were located using a structured search strategy. Searches were made in Scopus, Web of Science, EBSCOhost (LISTA), ProQuest, and IEEE Xplore with Google Scholar as an additional source to find newly published and other research in grey literature. These techniques included using Boolean operators, phrase searching and truncation in order to retrieve both conceptual and technical papers. The criteria for selecting studies grouped other studies together by their ability to meet specific criteria for inclusion; all were required to be studies that focused on academic or college/university libraries, to have discussed the use of AI or machine learning technologies in library services or management and provided results or arguments related to information access, user services, accessible design, and digital inclusion.

The studies included empirical (e.g., survey studies, qualitative content reviews, technical system studies) as well as conceptual studies (e.g., ethical frameworks and strategic discussion) showing that the study of AI how it is being used in libraries has a wide range of similarity among library researchers from number of disciplines. Studies that were published only in a language other than English were excluded from the study. Studies that discussed libraries that were not exclusively academic, had no intentional use of AI, or discussed library services or access/information both types of users were also excluded.

The selection process followed a staged screening procedure. After retrieval, all records were exported to a reference management system and duplicates were removed. Titles and abstracts were screened for relevance to AI adoption in academic libraries. Studies meeting initial relevance criteria were then assessed in full text to confirm alignment with the research questions. Throughout the process, reasons for exclusion were documented, particularly for studies that mentioned AI but did not address academic library contexts or that discussed digital transformation without AI-specific content. Furthermore, data extraction was conducted using a structured template to ensure consistency across studies. Extracted information included bibliographic details, study location or context, research design, AI technologies examined, and the library functions addressed.

Given that the included literature comprised mixed publication types (conference proceedings, journal articles, conceptual papers, and systematic reviews), a flexible quality appraisal approach was used. Studies were assessed for clarity of aims, methodological transparency, relevance to academic libraries, and strength of evidence supporting their conclusions. The extracted findings were synthesized through thematic analysis using both deductive and inductive coding. Deductive coding followed the predefined thematic structure of the review, specifically: (1) AI applications in academic libraries, including the types of technologies used and their service functions; (2) AI and the digital divide, focusing on accessibility, inclusive information access, and user experience; and (3) challenges and considerations, including technical, organizational. Inductive coding was used to capture recurring cross-cutting themes that emerged across studies, such as librarians' concerns about workforce displacement, uneven institutional readiness in developing contexts, the importance of staff

capacity-building, and the tension between AI-driven efficiency and ethical responsibility. Lastly, this study relied exclusively on published literature and did not involve primary data collection; therefore, no datasets were generated or deposited in a public repository. However, to support replicability, the search strategy, eligibility criteria, and thematic coding framework were documented, and the final list of included studies can be provided upon request.

III. RESULTS AND DISCUSSION

This section presents the synthesized findings from the systematic literature review and discusses how artificial intelligence (AI) is currently being adopted in academic libraries to improve information access and user services, as well as how such adoption relates to bridging the digital divide. The discussion is organized into two major themes: AI Applications in Academic Libraries with its sub-themes: AI Technologies Used in Academic Libraries and Functions of AI in Supporting Information Access and User Services; AI and the Digital Divide in Academic Libraries with its sub-themes: AI-Driven Enhancements to Accessibility and Inclusive Information Access and Impact of AI on User Experience in Academic Library Services; and Challenges and Considerations in AI Adoption in Academic Libraries.

3.1. AI Applications in Academic Libraries

Academic libraries are largely driven by the desire to increase work efficiency, improve discovery systems and provide scalable user support for the use of AI technology in their institutions. While there have been many studies conducted that have noted how AI has become a globally relevant form of information, there are still many academic libraries that are not adequately prepared or able to implement AI due to varied levels of preparedness and an inability to absorb the technology into their current infrastructures (Abayomi et al., 2021). Moreover, the

following are the sub-themes: *AI Technologies Used in Academic Libraries* and *Functions of AI in Supporting Information Access and User Services*.

3.1.1. AI Technologies Used in Academic Libraries

The use of machine learning (ML) as part of an AI implementation strategy is an essential aspect of the design and implementation of many academic libraries' services. According to the comprehensive body of research and analysis, Harisanty et al. (2023) identify some of the key ways that AI is being integrated into library services—specifically with respect to improving search capabilities (through enhanced metadata, improved indexing methods, enabling automated workflows, etc.). The body of literature on the application of machine learning indicates that it will likely become a foundational layer of "smarter" academic library services (since it provides the ability to detect patterns in usage and bibliographic data, leading to optimal service delivery, (e.g., recommendations for other materials based on your previous usage, identifying potential indexing errors within the catalogue, improved findability), machine learning is likely to serve both as an end-user feature and as a facilitating foundation for discovery systems and metadata infrastructure used by the library to provide user access to resources (e.g., they will both provide the ability to improve user service but provide the infrastructure that allows for access).

Moreover, Tundrea et al. (2020) describe a web client application for library management that makes use of machine learning (ML) and artificial intelligence (AI) technologies to satisfy the needs of staff and patrons. Through a number of features, including the ability to search for individuals or books using QR codes, the program aims to streamline the book reservation process and ease the work of library staff. By incorporating AI and ML into the application, librarians can analyze reader selections, develop an automated recommendation system, and find new books that users might find interesting. Additionally, publishing houses receive feedback from the applicant.

3.1.2. Functions of AI in Supporting Information Access and User Services

Chen et al. (2021) explored how the university library can use artificial intelligence (AI) to assist in the construction of information. Using data mining and surveys, the researcher examined past and current smart libraries and their limitations. The foundation has provided a developing intelligence libraries with AI, as well as a connection between AI and the growing number of students in the education system. The overview of the applications has been provided, information measures, and documents/products that can be used to create intelligence libraries.

Li discussed how AI can be used in network security for library networks. In the study, the library networks in regards to the definition and types of security libraries and developed a preventive strategy for library networks using AI. The methods are presented for using AI technology and analytical hierarchy to evaluate library network security conditions and improve the ability to perform in real time and predictively. Li described the importance of data fusion, hierarchical artificial immune system (AI) assessment, and a novel population-based algorithm to enhance network security for library networks. The results of the observations in supporting the ability of AI to provide libraries with increased protection and reliability in the library management systems.

3.2 AI and the Digital Divide in Academic Libraries

While AI in academic libraries can help close the gap between those who have computers and those who don't, it could lead to further inequity; likewise in academic libraries, there is not just a lack of devices or internet connection that contributes to a digital divide but also lack of digital literacy, searching skills, and the users' ability to use those resources through traditional library systems. By having the ability to simplify-search for information and personalize assistance to users with various levels of ability, AI has become a very useful tool in providing users who have difficulty accessing digital resources via traditional means, (Adeyemi & Muhammed-Jamui,

2025). Moreover, the following are the sub-themes: *AI-Driven Enhancements to Accessibility and Inclusive Information Access* and *Impact of AI on User Experience in Academic Library Services*.

3.2.1. *AI-Driven Enhancements to Accessibility and Inclusive Information Access*

Pence (2022) evaluated the possible effects of artificial intelligence (AI) on libraries. Pence provides a number of important applications for the use of AI in libraries including: analyzing data, allowing for remote access to library information and performing expansive searches on data collected from library systems. By collaborating with existing AI applications used by campus departments, libraries can become centers of information sharing and connectivity, giving librarians more time to provide advanced research knowledge.

Meanwhile, Hussain (2022) examined the potential benefits and barriers to integrating AI into library services. This study involved a qualitative analysis that utilized content analysis techniques. The study's results suggest that AI has the potential to improve library services. Conversely, the author also identifies several barriers to implementing AI within libraries, including financial constraints, librarians' attitudes, and technological limitations. The author concludes that if libraries employ AI technology, they can improve their service models and accelerate the development of their libraries. The article also identifies several inexpensive AI programs that librarians and information professionals can use to enhance their library service models.

3.2.2. *Impact of AI on User Experience in Academic Library Services*

Various studies have identified a link between increasing user satisfaction through user experience (UX), and AI (Artificial Intelligence) and how it helps to enhance UX in terms of both efficiency, reduced mistakes, and smarter resource discovery. According to Han (2021), AI could convert digital libraries into intelligent metadata platforms that support data collection and facilitate decision-making by assisting with data analysis. With the elimination of duplicate work and reduction in user errors, AI could hopefully

improve speedier and more satisfying service. Han also discussed the importance of utilizing human capabilities together with the capabilities of AI to be successful when using these technologies to improve UX; thus, rather than providing a replacement for librarians, AI provides a complementary service to users. This reflects an important point in the UX literature: While AI can support enhancing the quality of services provided to users, users generally benefit from human support and direction, particularly when performing complicated academic research tasks.

In addition, Yuan (2021) identified the major impact AI have on the future growth and development of libraries through the use of new technologies. It was suggested that AI supports information services, development of new resources, and support librarian training, thus supporting the concept that AI is a strategic path for libraries to take in future formalizations of library services.

In summary, the studies cited in this review indicated that AI could improve the overall experience of library users by increasing the quality of services provided to users in terms of faster, more relevant, and more consistent service; however, such improvements in service to users can be dependent on an institution's readiness for implementation of AI and on the development of its staff, particularly when preparing staff to integrate technology into the services provided to library users.

3.3. Challenges and Considerations in AI Adoption in Academic Libraries

The reviewed literature consistently stresses that significant technical, organizational, and ethical issues obstruct the adoption of AI despite its potential for impact. These issues span both developed and developing contexts, but vary in intensity. A significant impediment identified by multiple studies is the lack of institutional capacity to implement AI. According to Ajani et al. (2022), academic libraries generally have substantial barriers such as limited budgets, inadequate technical infrastructure, inconsistent power supply, and insufficient staff training which

significantly limit their ability to move from even being aware of AI to being able to implement it.

Abayomi et al. (2021) emphasized the importance of training and professional development for librarians to develop the skills required to adopt AI. These findings imply that technical adoption is inextricably linked to organizational investments in and the workforce's readiness to adopt AI technologies. Orubebe, et al. (2025) further argued that the limited adoption of AI globally partly results from the large number of studies which are geographically restricted and focused on one institution instead of many compared to each other. The review identified many barriers related to inadequate AI competency, low education and level of awareness of AI technologies, insufficient infrastructure and inadequate strategic planning. Concerns regarding job displacement were also raised in their review, which echo earlier findings among Nigerian librarians regarding concerns about job displacement. Ethical considerations concerning fairness, transparency, and privacy are prominent across nearly all literature reviewed.

Purwanto et al. (2024) examined the ethical issues associated with using AI in organizations and identified as important ethical issues algorithmic bias, privacy of data, and workforce displacement. Their findings are well positioned to inform a future study of AI adoption by academic libraries since libraries hold sensitive information on users and operate under strong professional values related to the protection of intellectual freedom and the privacy of information used. For these reasons, Mishra (2023) specifically addressed the ethical considerations of using AI and machine learning in libraries and information centres. Mishra noted that there were many risks associated with the adoption of AI that librarians must be aware of, including, but not limited to, discrimination, surveillance, vulnerabilities (and other risks), reduction in face-to-face interaction between librarians and their users, and job displacement. Mishra suggested that all libraries develop proactive ethical frameworks and best practices to ensure that AI/ML systems are consistent with the missions of libraries and serve their users equitably.

IV. CONCLUSION

This systematic literature review examined how artificial intelligence (AI) is being adopted in academic libraries to enhance information access and user services, and how such adoption relates to bridging the digital divide. Across the reviewed studies, AI adoption is consistently presented as a promising pathway for strengthening library operations and improving service delivery. Academic libraries are applying AI through technologies such as machine-learning-enabled library management systems, smart library infrastructure, recommendation tools, and security-focused AI mechanisms. These technologies support key service functions including automation of routine tasks, improved indexing and discoverability, personalized information access, and more efficient user support. However, the findings also show that AI adoption remains uneven and is strongly shaped by institutional readiness, resource availability, and staff capacity, particularly in developing contexts where infrastructure and funding limitations limit implementation.

In relation to the digital divide, the literature suggests that AI has potential to improve accessibility and inclusive information access by enabling remote services, enhancing discovery systems, and supporting more user-friendly interaction with library resources. At the same time, the review highlights that AI does not automatically promote equity. Ethical and organizational concerns—including algorithmic bias, privacy risks, opaque decision-making, workforce displacement fears, and limited staff training—may weaken user trust and create new barriers to access. In addition, there is a need for deeper investigation into ethical governance in academic libraries, particularly around privacy protection, transparency, bias mitigation, and the changing role of librarians in AI-supported service environments.

REFERENCES

- [1.] Abayomi, O. K., Adenekan, F. N., Abayomi, A. O., Ajayi, T. A., & Aderonke, A. O. (2021). Awareness and perception of the artificial intelligence in the management of university libraries in Nigeria. *Journal of Interlibrary Loan, Document Delivery & Electronic Reserve*, 29(1-2), 13-28. <https://doi.org/10.1080/1072303X.2021.1918602>
- [2.] Adeyemi, I. O., & Muhammed-Jamiu, R. (2025). Analyzing the Socio-economic and Environmental Impacts of Artificial Intelligence Adoption in Libraries. *Handbook of Trends and Innovations Concerning Library and Information Science: A Multidisciplinary Approach*, 473. <https://tinyurl.com/2ht5jz4c>
- [3.] Ajani, Y. A., Tella, A., Salawu, K. Y., & Abdullahi, F. (2022). Perspectives of Librarians on Awareness and Readiness of Academic Libraries to Integrate Artificial Intelligence for Library Operations and Services in Nigeria. *Internet Reference Services Quarterly*, 26(4), 213–230. <https://doi.org/10.1080/10875301.2022.2086196>
- [4.] Han, K. (2021). Research and Exploration of Metadata in Artificial Intelligence Digital Library. *Journal of Physics: Conference Series*, 1915(2), 022061. <https://doi.org/10.1088/1742-6596/1915/2/022061>
- [5.] Harisanty, D., Anna, N. E. V., Putri, T. E., Firdaus, A. A., & Noor Azizi, N. A. (2025). Is adopting artificial intelligence in libraries urgency or a buzzword? A systematic literature review. *Journal of Information Science*, 51(2), 511-522. <https://journals.sagepub.com/doi/abs/10.1177/01655515221141034>
- [6.] Hussain, Abid (2021). Use of Artificial Intelligence in the Library Services: Prospects and Challenges. Available at SSRN: <https://ssrn.com/abstract=5142938>
- [7.] Ikwuanusi, U. F., Adepoju, P. A., & Odionu, C. S. (2023). AI-driven solutions for personalized knowledge dissemination and inclusive library user experiences. *International Journal of Engineering Research Updates*, 4(2), 052-062. <https://tinyurl.com/52dx8n7n>

-
- [8.] Khan, R., Gupta, N., Sinhababu, A., & Chakravarty, R. (2024). Impact of conversational and generative AI systems on libraries: A use case large language model (LLM). *Science & technology libraries*, 43(4), 319-333.
<https://www.tandfonline.com/doi/abs/10.1080/0194262X.2023.2254814>
- [9.] Kulkanjanapiban, P., Silwattananusarn, T., & Lambovska, M. (2025). Research on AI-driven innovations and services in academic libraries: A bibliometric and systematic literature review. *Journal of Data and Information Science*, 10(3), 1-51.
<https://sciendo.com/pdf/10.2478/jdis-2025-0036>
- [10.] Li, C. (2021). Construction of Intelligent Service System of University Library Based on Internet of Things in Artificial Intelligence Environment. 2021 5th *International Conference on Intelligent Computing and Control Systems (ICICCS)*, 471-474.
<https://doi.org/10.1109/ICICCS51141.2021.9432378>
- [11.] Lythreatis, S., Singh, S. K., & El-Kassar, A. N. (2022). The digital divide: A review and future research agenda. *Technological Forecasting and Social Change*, 175, 121359.
<https://www.sciencedirect.com/science/article/pii/S0040162521007903>
- [12.] Mishra, S. (2023). Ethical implications of artificial intelligence and machine learning in libraries and information centers: A frameworks, challenges, and best practices. *Library Philosophy and Practice (e-journal)*, 7753.
https://digitalcommons.unl.edu/cgi/viewcontent.cgi?params=/context/libphilprac/article/14939/&path_info=auto_convert.pdf
- [13.] Orubebe, E. D., Oloniruha, E. A., & Oladokun, B. D. (2025). Adoption and utilization of artificial intelligence in academic libraries: Challenges and opportunities in developed and developing nations. *International Journal of Knowledge Content Development & Technology*, 15(3), 23-35. <https://koreascience.kr/article/JAKO202523336007195>.
- [14.] Pawar, V. M. (2024). Using AI in academic libraries: Application and challenges. *International Journal of Innovative Science and Research Technology (IJISRT)*, 2747-2749. <https://pdfs.semanticscholar.org/2dc9/068fb13b462a8176000c57774617900b09be.pdf>
-

-
- [15.] Pence, H. E. (2022). Future of Artificial Intelligence in Libraries. *The Reference Librarian*, 63(4), 133–143. <https://doi.org/10.1080/02763877.2022.2140741>
- [16.] Purwanto, A. N. I., Fauzan, M., Widya, T., & Azzaky, N. S. (2024). Ethical Implications and challenges of AI implementation in business operations. *TechComp Innovations: Journal of Computer Science and Technology*, 1(2), 68-82. <https://doi.org/10.70063/techcompinnovations.v1i2.52>
- [17.] Rafique, H., Almagrabi, A. O., Shamim, A., Anwar, F., & Bashir, A. K. (2020). Investigating the acceptance of mobile library applications with an extended technology acceptance model (TAM). *Computers & Education*, 145, 103732. [sciencedirect.com/science/article/pii/S0360131519302854](https://www.sciencedirect.com/science/article/pii/S0360131519302854)
- [18.] Țundrea, E., Turcuț, F., & Fotea, S. L. (2020). Challenges and Opportunities When Integrating Artificial Intelligence in the Development of Library Management Systems. In S. L. Fotea, I. Ș. Fotea, & S. A. Văduva (Eds.), *Challenges and Opportunities to Develop Organizations Through Creativity, Technology and Ethics* (pp. 369–382). Springer International Publishing. https://doi.org/10.1007/978-3-030-43449-6_22
- [19.] Williams, D. J. (2023). Digital initiatives in academic libraries: Challenges and opportunities. *portal: Libraries and the Academy*, 23(2), 387-398. <https://muse.jhu.edu/pub/1/article/887663/summary>
- [20.] Xue, L., Rashid, A. M., & Ouyang, S. (2024). The unified theory of acceptance and use of technology (UTAUT) in higher education: A systematic review. *Sage Open*, 14(1), 21582440241229570. <https://journals.sagepub.com/doi/full/10.1177/21582440241229570>
- [21.] Yuan, X. (2021). Research on the Development of Library in the Era of Artificial Intelligence. 2021 16th *International Conference on Computer Science & Education (ICCSE)*, 1052–1057. <https://doi.org/10.1109/ICCSE51940.2021.9569594>
-