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Education and Learning in the Context of AI and Higher Education: Libraries as Mediators of AI-Driven Digital Access

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Abstract
This paper examines the impact of Artificial Intelligence (AI) on the concepts of education, digital libraries, and the current state of higher education institutions in India. Citations systematically collected through Google Scholar using specific terms from the literature review discuss the impact of the disruptive nature of AI on the concepts of education, digital literacy, and the academic community. The method of the scoping review of AI in Digital Libraries and Higher Education, along with the tabulation method using MS Excel, proved helpful in compiling the study's results. These results highlight the library's role in disrupting the digital world of education through the impact of AI.

Keywords: higher education and digital libraries; learning; pedagogy; academic ecosystems; artificial intelligence.

Introduction

The increasing literature on Artificial Intelligence (AI) and the changing role it plays in the Indian education scenario has been defined in the literature by the ensuing benefits and challenges the implementation of AI faces in the integration process that the Indian education system is undergoing. A significant number of literature references have been generated related to the application and utilization of Generative AI tools in the Indian educational scenario, leading ultimately to the implications associated with the methodological restructuring associated with the implementation and application processes in the Indian educational scenario. Alongside the requirements associated with AI literacy in the Indian educational system in adapting to the new AI-based environment for educational purposes has been an essentially significant requirement in the Indian educational scenario. Artificial intelligence (AI) has been recognized as one of the key drivers in reshaping libraries for higher educational purposes in the digital information era. The literature collectively addresses the role played by the library in the AI-related disruption impact and the preservation of academic integrity in the educational institute.

Method

The study has focused on the literature observed and references collected through Google Scholar platform with the following keywords/phrases:

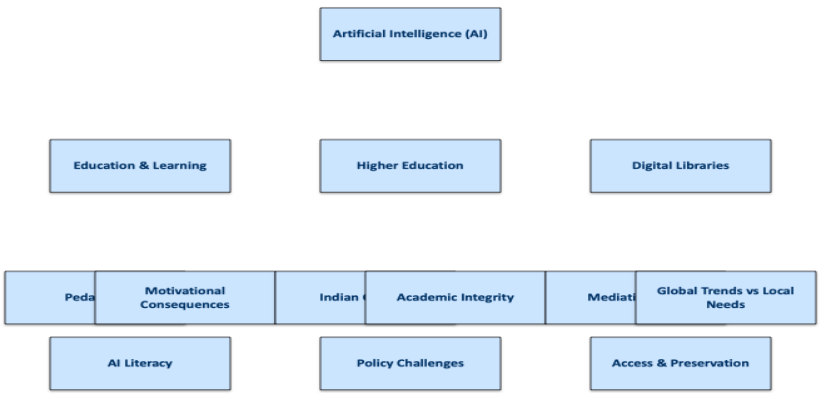
1. Education and Learning in the Context of AI

2. Education and Learning in the Context of AI During 2024-2025
3. Education and Learning in the Context of AI in India during 2024 - 2025
4. Education and Learning in the Context of AI and the Role of Libraries
5. Education and Learning in the Context of AI and the Role of Digital Libraries
6. Higher Education in the Context of AI and Role of Digital Libraries
7. Higher Education in the Context of AI and Digital Libraries
8. Higher Education, AI, and Digital Libraries

The study has applied simple table method as well as scoping review for the analysis of recent literature with the focus on Education, digital libraries and higher education system with the emphasis on Indian scenario as well. The data was collected during January till August 2025 (most updated) to add new results in order to provide comprehensive outlook. The collected data was tabulated in MS-EXCEL program. This tool has been helpful in segregated data keeping as well as for visualisation and concept map idea, powerpoint as well as following tools were helpful:

- NetworkX was used to structure the conceptual relationships as a graph (nodes = concepts, edges = relationships).
- Matplotlib was used to visualize the graph in a clean, academic diagram format.

The concept map (for the scoping review purpose, later in the study presented) was developed using Python libraries NetworkX (for structuring concept relationships) and Matplotlib (for visualization). These tools enabled clear mapping of AI's intersection with education, higher education, and digital libraries, ensuring systematic representation of the literature findings."



Concept Map: AI, Education, and Digital Libraries in India (A visual representation of literature findings created in Power Point).

Education and Learning in the Context of AI

Organized the reference list (n = 32, 2016–2024) into a thematic table so the review flows more clearly. The further discussion reflects the refined and structured version with themes, focus, and key sources:

Thematic Table: Education and Learning in the Context of AI

Theme	Focus / Contribution	Key References
1. Conceptual Foundations of	Early arguments and conceptual framing of AIâ€™s role in education; vision,	Luckin & Holmes (2016); Luckin & Cukurova (2019); Hwang et al. (2020); Carvalho et al. (2022); Perrotta &

AI in Education	challenges, and design approaches.	Selwyn (2020); Pham & Sampson (2022)
2. Ethics, Policy & Governance	Frameworks for responsible AI use, community-wide ethics, and institutional policy design.	Pedro et al. (2019); Holmes et al. (2022); Holmes & Tuomi (2022); Chan (2023); Mhlanga (2023); Yuan (2024)
3. Learning Sciences & Pedagogical Design	AI-enabled design of learning environments, ecologies, and personalized learning pathways.	Cope et al. (2021); Tapalova & Zhiyenbayeva (2022); Elimadi et al. (2024); Fang et al. (2023)
4. Precision, Adaptive & Personalized Learning	AI systems for personalization, learner modeling, and adaptive pathways.	Yang (2021); Niemi (2021); Lee et al. (2023); Gligorea et al. (2023); Ouyang & Jiao (2021); AbuSahyon et al. (2023)
5. AI in Language Learning (EFL/ESL)	AI-driven support for second language acquisition and English learning systems.	Costa et al. (2019); Jiang (2022); Lee et al. (2023); AbuSahyon et al. (2023)
6. AI Literacy, Competencies & Human Skills	Focus on AI literacy, new competences, and behavioral development in students.	Grassini (2023); Benvenuti et al. (2023); Xiao et al. (2024); Chen et al. (2024)
7. Generative AI & Emerging Tools (ChatGPT, etc.)	Ethical use, motivational impact, and consequences of generative AI in education.	Gillani et al. (2023); Grassini (2023); Hmoud et al. (2024); Mhlanga (2023)
8. International & Contextual Perspectives	Cross-national experiences, cultural contexts (China, international case studies).	Chen et al. (2024); Yuan (2024); Pedro et al. (2019)
9. Future Directions & Open Questions	â€œBlack boxâ€ challenges, future learning ecologies, integration of AI with sustainable development goals.	Gillani et al. (2023); Carvalho et al. (2022); Pedro et al. (2019); Holmes & Tuomi (2022)

The application of Artificial Intelligence (AI) in education has expanded rapidly over the last decade, moving from conceptual debates to practical implementations. Early works established the vision and foundations of AI in learning contexts, emphasizing its potential to enhance pedagogy and learner engagement (Luckin & Holmes, 2016; Hwang et al., 2020 : Luckin & Cukurova, 2019; Carvalho et al., 2022). Precision education, learner modeling, and context-aware support systems are positioned as transformative for individualized pathways (Yang, 2021; Tapalova & Zhiyenbayeva, 2022; Lee et al., 2023). Research in the area of language acquisition has emphasized the potential of AI in second language acquisition (Costa et al., 2019; Jiang, 2022; AbuSahyon et al.). This potential is particularly evident in intelligent tutoring, chatbot-based learning, and adaptive English learning systems. The other very important concern is ethics, governance, and policymaking. The strategic and responsible usage of infrastructures and ethical norms for the whole community have been developed to aid institutions and decision-makers (Pedro et al., 2019; Holmes et al., 2022; Chan, 2023 ; Hmoud et al., 2024; Mhlanga, 2023). Related work focuses on AI literacy and training, highlighting AI's role in fostering new learning skills, creativity, and changes in learning behaviors (Benvenuti et al., 2023;

Xiao et al., 2024; Gillani et al., 2023; Grassini, 2023). These issues and developments occur within an international and cross-national setting and context, particularly in higher education and national learning systems (Chen et al., 2024; Yuan, 2024). The entire discussion symbolizes a stream from concept to practice and an ongoing conflict between issues and concepts associated with principles, ethics, AI literacy, and the revolutionary AI generative tool, as it alters the future of Education.

Education and Learning in the Context of AI during 2024–2025

The following structured **2024–2025 references (n = 28)** into a clear **thematic table** that shows research clusters in *Education and Learning in the Context of AI*.

Thematic Table: Education and Learning in the Context of AI (2024–2025)

Theme	Focus / Contribution	Key References
1. Ethical, Philosophical & Policy Perspectives	Ethical challenges, policy frameworks, computational ethics, and philosophical analyses of AI in education.	Chen H. (2024); Chen N. S. et al. (2024); Storozhyk (2024); Adel et al. (2024); Wilton et al. (2024); Alqahtani & Wafula (2025)
2. Reviews, Frameworks & Meta-Analyses	State-of-the-art reviews, bibliometric analyses, frameworks for digital literacy and AI literacy.	Fu et al. (2024); Bayly-Castaneda et al. (2024); Baskara (2025); Ma et al. (2025)
3. Generative AI & Pedagogical Implications	Opportunities and challenges of ChatGPT/GenAI in education; effects on teaching, motivation, and learning outcomes.	Noroozi et al. (2024); Collie & Martin (2024); Giannakos et al. (2025); Wood & Moss (2024); Hmoud et al. (2024); Reyes-Villalba et al. (2024)
4. AI Literacy, Skills & Competences	Preparing learners and teachers with AI literacy, prompt engineering, digital skills, and future-ready competences.	Walter (2024); Chen N. S. et al. (2024); Baskara (2025); Mohamed et al. (2025)
5. Adaptive, Personalized & Inclusive Learning	AI-enabled personalized learning paths, adaptive systems, and inclusive design (e.g., UDL).	Elimadi et al. (2024); Bayly-Castaneda et al. (2024); SaborÃo-Taylor & Rojas-RamÃrez (2024); Ellikkal & Rajamohan (2025)
6. Teachers, Students & Motivation	Teacher engagement, student intentions, higher education contexts, and motivational impacts of AI.	Milicevic et al. (2024); Collie & Martin (2024); Mohamed et al. (2025); Cai et al. (2025)
7. Digital Transformation & Socioeconomic Perspectives	Role of AI in overcoming barriers, transforming research and education, and equity in digital learning.	Edeni et al. (2024); GuillÃ©n-GÃ¡mez et al. (2024); Reyes-Villalba et al. (2024); Ukwandu et al. (2025)
8. Future-Oriented & Philosophical Outlooks	Future of AI in education, teacherâ€“student dynamics, and systemic transformation.	Storozhyk (2024); Ukwandu et al. (2025); Giannakos et al. (2025)

This organization shows that 2024–2025 scholarship has shifted heavily toward generative AI, literacy frameworks, ethics/policy debates, and inclusive/adaptive learning, while also engaging with future-oriented transformations of education systems.

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Artificial Intelligence (AI) in education during 2024–2025

Recent scholarship (2024–2025) on Artificial Intelligence (AI) in education reflects a significant shift toward generative AI, ethical debates, and the redesign of learning ecologies. Ethical and policy perspectives have become central, with researchers examining challenges of accountability, transparency, and computational ethics in the wake of widespread adoption (Chen, 2024; Adel et al., 2024). Global reports and philosophical analyses underscore the need for coherent governance frameworks and culturally sensitive policies (Chen N. S. et al., 2024; Storozhyk, 2024; Alqahtani & Wafula, 2025). Other research focuses on improvements and risks of over-dependency and misapplication from a moral standpoint (Noroozi et al., 2024; Collie & Martin, 2024; Giannakos et al., 2025; Wood & Moss, 2024). Also developing are models of literacy, prompt design, and resilient skills (Walter, 2024; Baskara, 2025; Mohamed et al., 2025), coming up as part of research on adaptive learning and personalization with AI support that promotes inclusiveness (Elimadi et al., 2024; Bayly-Castaneda et al., 2024; Saborío-Taylor & Rojas-Ramírez, 2024; Ellikkal & Rajamohan, 2025). Meta-analyses and bibliographic research are integrating cutting-edge developments and information essential to establishing evolving trends on personalization, professional needs, and implications of AI within education (Fu et al., 2024; Ma et al., 2025). Also, research has established that AI (Edeni et al., 2024; Guillén-Gámez et al., 2024; Ukwandu et al., 2025) has capabilities to eliminate disparities and optimize digitization. Overall, during 2024–2025 literature signals a maturing discourse: moving beyond speculative potential to practical integration, ethical safeguards, and systemic transformation, with generative AI, literacy, and inclusion at the forefront of debates about the future of education.

Education and Learning in the Context of AI in India (2024–2025)

Thematic table for references on Education and Learning in the Context of AI in India (2024–2025):

Theme	Key References	Focus
Systematic & Bibliometric Reviews	Kumari (2025); Kavitha & Joshith (2024, 2025); Yu et al. (2025)	Synthesizing trends, systematic review of AI in Indian education, bibliometric retrospect (20 years), mapping global + Indian perspectives.
Policy & NEP 2020 Alignment	Prajapati (2025); Shukla et al. (2025); Prasad (2025)	AIâ€™s role in shaping Indiaâ€™s NEP 2020 vision, digital well-being, institutional/policy readiness for AI integration.
Higher Education Transformation	Pant et al. (2025); George (2024); Abdul Sayeed & Dravichi (2024); Mahajan et al. (2025); Potluri & Kilaru (2025)	AI in Indian higher education: opportunities, challenges, sustainability practices, comparative contexts (Indiaâ€“Kazakhstan).
Personalized & Hybrid Learning	Jeyakumaran et al. (2025); Ellikkal & Rajamohan (2025); Makhija et al. (2025); Kavitha & Joshith (2025)	Personalized learning, hybrid/indigenized models, AI-driven pedagogy in Indian classrooms.
Student Perceptions & Readiness	Kumar et al. (2025); Singh et al. (2025); Sharma et al. (2024); RoÅ¾man et al. (2025)	UTAUT-based and comparative studies on AI literacy, readiness, and Gen Zâ€™s academic performance in India.

Socio-Economic Inclusion & Rural Education	Goswami & Sharma (2024); Darda et al. (2024); Rathod (2025)	AI for bridging inequities, Alexa in rural pedagogy, libraries as inclusive AI-driven education hubs.
Faculty & Teacher Perspectives	Prajapti & Dadariya (2025); Maharani et al. (2025)	AIâ€™s role in reducing teacher stress, challenges in teacher education, and cross-country perspectives (Indiaâ€“Indonesia).
Cross-Industry & Interdisciplinary Views	Yadav & Shrawankar (2025); Singh & Goyal (2025); Karan & Angadi (2025)	AI across industries with education focus, conceptual explorations, comparative reviews of Indian & global perspectives.

Education and Learning in the Context of AI in India (2024–2025)

Recent systematic and bibliometric reviews provide an overarching view of trends, research trajectories, and policy relevance. Kumari (2025) identifies significant progress in AI-driven interventions for student outcomes, while Kavitha and Joshith (2024, 2025) trace bibliometric shifts and pedagogical breakthroughs over two decades. Yu et al. (2025) situate Indian debates within global research patterns, mapping opportunities and persistent concerns. The role of AI itself, with its contributions underscoring its impact on advancing equity (Prajapati, 2025; Shukla et al., 2025; Prasad, 2025), digital well-being, and institutional readiness, has also emerged. Education appears as an important arena, and the contributions relate to the opportunities and challenges (Pant et al., 2025; George, 2024; Mahajan et al., 2025) for, and practices related to, higher education institutions in India. The sections develop the earlier comparative study positions India within (Potluri & Kilaru, 2025; Maharani et al., 2025) relative to other settings.

Personalized and hybrid learning have emerged as prominent claims in the literature regarding educational growth. Though Jeyakumaran et al. (2025) highlight the changing teaching process for AI-enabled learning, Makhija et al. (2025) mention hybrid learning models that include indigenized values. AI's transformative role in teaching methods. Studies indicate a mixed level of readiness for AI and the literacy level of Indian students, as evidenced by UTAUT-based studies (Kumar et al., 2025; Singh et al., 2025; Sharma et al., 2024; Rožman et al., 2025; Kavitha & Joshith, 2025). Moreover, socio-economic inclusivity is one of the themes: AI helps reduce inequality in rural education through the use of technology (Goswami & Sharma, 2024; Darda et al., 2024; Rathod, 2025), such as voice assistants and faculty-centric research focuses on how (Prajapti & Dadariya, 2025; Yadav & Shrawankar, 2025) AI reduces teacher stress, teacher training, and institutional changes through AI training.

Education and Learning in the Context of AI and the Role of Libraries

Thematic table: Education and Learning in the Context of AI and the Role of Libraries (2021–2025):

Theme	Key References	Focus
Conceptual Frameworks & Digital Transformation	Okunlaya et al. (2022); Ubochi & Soroibe (2024); Halder (2025)	Libraries as AI-driven information hubs; conceptual frameworks for educational transformation; libraries as transformative learning spaces.
Generative AI & Academic Libraries	Narayanan (2024); Aithal & Aithal (2023); Zeb et al. (2025)	Impact of ChatGPT and generative AI on higher education libraries, knowledge sharing, and educational research.

School Libraries & AI Literacy	Hossain (2025); Dei Patris et al. (2025); Ajwa et al. (2024)	Developing AI literacy, improving educational support, advancing librarian competencies, and innovations in literacy libraries.
Librarian Skills, Competencies & Training	Andersdotter (2023); Tait & Pierson (2022); Kumar et al. (2024)	Preparing librarians for AI, LIS curriculum redesign, professional learning circles, and competency-building.
Leadership, Adoption & Institutional Readiness	Shal et al. (2024); Lo (2023); Buitrago-Ciro et al. (2025)	Leadership styles, institutional strategies, and comparative analyses of AI adoption in academic libraries.
Ethical, Equitable & Inclusive AI Practices	Hodonu-Wusu (2025); Zeb et al. (2025)	Ethical considerations, equitable access, AI citizenship, and responsible AI use in library contexts.
Libraries Supporting Online & Inclusive Learning	Kumar et al. (2024); Ajwa et al. (2024); Halder (2025)	Libraries supporting digital and online learning environments, inclusive access, and literacy development.
Mobile & Digital Learning Tools	Yip et al. (2021)	Adoption of mobile library apps as tools for higher education learning, comparative cross-country study.

Libraries are increasingly positioned as critical actors in shaping AI-driven education. Conceptual frameworks highlight their role in digital transformation and as inclusive learning hubs (Okunlaya et al., 2022; Ubochi & Soroibe, 2024; Halder, 2025). The emergence of Generative AI in academic libraries is one of the many transformations and challenges facing researchers (Narayanan, 2024; Aithal & Aithal, 2023; Zeb et al., 2025), presenting new opportunities for them. Institutions are teaching individuals how to interact with and prepare themselves for a future (Hossain, 2025; Dei Patris et al., 2025; Tait & Pierson, 2022; Andersdotter, 2023) where AI will be an integral part of their daily lives. The preparedness of institutions (Shal et al., 2024; Lo, 2023; Buitrago-Ciro et al., 2025; Hodonu-Wusu, 2025) and their management of AI use play a crucial role in determining the extent to which GenAI is utilized and developed globally. A library's function is being viewed in connection with the rise of online education and digital literacy (Kumar et al., 2024; Ajwa et al., 2024; Yip et al., 2021).

Impact of AI on Education and Learning and the Function of Digital Libraries
Thematic Table: AI-Related Education and Learning and the Function of Digital Libraries

Theme	**Key References**	**Focus**
Conceptual and Framework Approaches	Okunlaya et al. (2022); Isiaka et al. (2024)	Evolving with AI technologies to transform digital Libraries; Managing Libraries' impact on the 4th IR and Libraries will contribute positively to developments impacting Higher Education.

Academic Libraries & Generative AI	Aithal & Aithal (2023)	Investigates how the advent of ChatGPT has changed the way higher education libraries offer services and provide students with educational opportunities.
Libraries Supporting Digital Learning and Online	Kumar et al. (2024)	Identifies the ways libraries can utilize educational technology and AI to facilitate online learning.
Use of AI for Research Enhancement and Searching	Shamsitdinova et al. (2024)	Utilization of Artificial Intelligence in Digital Libraries for Enhanced Access and Altered Research Practices, and Advanced Search Functions

Artificial intelligence is drastically affecting the education and research sectors through digital libraries (Okunlaya et al., 2022). AI-based services are at the forefront of the digital revolution in university education, with libraries being compelled to align with technological advancements to emerge as tech-based learning centers (Isiaka et al., 2024) within the context of the Fourth Industrial Revolution. AI-based technologies, such as generative AI, like ChatGPT, hold potential for improvement in library networks (Aithal & Aithal, 2023; Kumar et al., 2024) within the context of higher education libraries. However, concerns regarding integrity and the accuracy of information also exist. There is an alignment of the library with educational technology and AI to support online distance education platforms. Additionally, AI-based search application tools within digital libraries (Shamsitdinova et al., 2024) are also increasing the efficiency of research by facilitating more accurate information retrieval. These developments collectively establish AI-enabled digital libraries as living entities that drive innovations, strengthen education, and are changing the landscape of the education environment beyond the conventional information storage function of the library.

Higher Education in the Context of AI and the Role of Digital Libraries

Thematic table: Higher Education in the Context of AI and the Role of Digital Libraries:

Theme	Key References	Focus
Conceptual Frameworks & Transformation	Okunlaya et al. (2022); Quy et al. (2023); Habib (2023); Isiaka et al. (2024); Rajkumar et al. (2024)	Digital transformation frameworks in higher education libraries: AI as a driver of systemic change and sustainability in strategic planning.
Generative AI & ChatGPT in Higher Education	Aithal & Aithal (2023); Vargas-Murillo et al. (2023); Meakin (2024); Foroughi et al. (2025); Fowler (2023)	Adoption, challenges, and educational implications of ChatGPT; impacts on learning, research use of libraries, and trust in AI systems.
Library Services & User Experience	Rafi et al. (2019). Yip et al. (2021); Panda & Kaur (2023); GÃ¼rsen et al. (2023); Kumar et al. (2024)	Enhancing digital library services, mobile applications, and user experience through AI and emerging technologies.
Leadership & Institutional Readiness	Shal et al. (2024); Eustachio et al. (2024)	Leadership styles, institutional culture, and acceptance of AI in higher education libraries.

Student & Faculty Skills / Information Literacy	Akakpo (2024); Hamzah et al. (2025); Ajwa et al. (2024)	Developing AI literacy, information literacy education, and supporting diverse learners in higher education contexts.
Ethics, Equity & Social Implications	Herke & Vicsek (2022); Hodonu-Wusu (2025, from previous section for continuity)	Attitudes toward automation and AI, ethical implications, and equity in higher education.
Metaverse & Emerging Technologies	Oladokun et al. (2024); Yu & Nazir (2021)	Integration of metaverse and 5G with AI in higher education libraries and teaching contexts.

Artificial intelligence (AI) is reshaping higher education, with digital libraries playing a pivotal role in this transformation. Foundational works (Okunlaya et al., 2022; Quy et al., 2023; Habib, 2023) highlight digital transformation frameworks that position libraries as central to institutional adaptation and transformation. Emerging technologies, such as AI, are being increasingly integrated into library services. This includes the utilisation of AI to facilitate online education, enhance research productivity, and develop sustainable service models (Rafi et al., 2019; Kumar et al., 2024; Rajkumar et al., 2024). The literature examines the use of generative AI and its impact on the way libraries support users in higher education. The studies provide insight into the innovative possibilities provided by generative AI and ChatGPT, but they also illuminate the challenges that come with reliance on generative AI, such as ethical issues and maintaining the integrity of the academy (Aithal & Aithal, 2023; Vargas-Murillo et al., 2023; Meakin, 2024; Foroughi et al., 2025; Fowler, 2023). Other studies focus on user trust in generative AI and its impact on the adoption of AI technologies by users (Yip et al., 2021; Panda & Kaur, 2023; Gürsen et al., 2023; Foroughi et al., 2025). Similar research examines how users experience AI capabilities through mobile library applications, AI-augmented behavioral changes, and digital service enhancements (Akakpo, 2024; Shal et al., 2024; Eustachio et al., 2024; Hamzah et al., 2025). The ethical and social ramifications of automation (Herke & Vicsek, 2022; Oladokun et al., 2024; Yu & Nazir, 2021) are also important, as are those posed by the emergence of experimental technologies, such as the metaverse and 5G.

Higher Education in the Context of AI and Digital Libraries

Thematic Table: Higher Education in the Context of AI and Digital Libraries

Theme	Focus	Key References
AI-driven transformation of academic libraries	Conceptual and practical frameworks for digital-first higher education libraries integrating AI.	Okunlaya et al. (2022); Rathod (2025); Chouia (2024)
Generative AI and ChatGPT in higher education	Impacts on library services, resource utilization, originality, and ethical use.	Aithal & Aithal (2023); Meakin (2024); Ogunjimi (2024)
Metadata, information access, and discovery	AI in improving metadata services, search functionalities, and research practices.	Titus (2024); Shamsitdinova et al. (2024)
Disruptive technologies	Emerging AI ecosystems reshaping higher education libraries.	Oladokun et al. (2024)

(Metaverse, Meta AI)		
Comparative and policy perspectives	Cross-national insights into policy, innovation, and inclusive practices in AI-enabled higher education libraries.	Rathod (2025)

This structure shows how AI in higher education libraries is studied across conceptual frameworks, practical adoption (metadata, search, digital-first models), disruptive innovations (Metaverse, generative AI), and policy/integrity issues. Foundational frameworks such as Okunlaya et al. (2022) propose innovative models for AI-enabled library services to drive the digital transformation of universities. Building on this, Rathod (2025) provides a comparative policy-oriented perspective, examining inclusive, digital-first higher education libraries in India and the United States. Titus (2024) highlighted the use of AI to enhance the application of metadata search functions for higher education institutions in Namibia, while Shamsitdinova et al. (2024) explored the strengths of artificial intelligence search engines for transforming the research process in digital libraries. In other areas of research related to the field of this project, the strength of AI in transforming the process of accessing information (Chouia, 2024) from higher education institutions is notable. The innovations of the near future, including the "Metaverse/Meta AI" proposed by Oladokun et al. (2024), demonstrate the potential of the future of academic libraries.

Higher Education and AI in the Context of Digital Libraries during 2024–2025
Thematic table: Higher Education and AI in the Context of Digital Libraries (2024–2025):

Theme	Focus	Key References
Conceptual and review studies	Mapping current knowledge on AI in higher education libraries and future directions.	Steiger (2024); Barsha & Munshi (2024); Rahmanova (2025)
AI for information access and discovery	Enhancing research practices, search systems, and resource utilization with AI.	Chouia (2024); Shamsitdinova et al. (2024); Meakin (2024)
Leadership and institutional readiness	Leadership styles, librarian roles, and organizational acceptance of AI.	Shal et al. (2024); Cahyono & Masruroh (2025)
Integrity, Policy, and Ethics	Developing frameworks for AI use, ethical policies, and academic integrity assurance.	Chigwada (2024); Ogunjimi (2024, from earlier cluster) ; Sheppard & Mayton (2024)
User perceptions and adoption	Exploratory Studies on Adoption & Perceptions of AI-Powered Tools for Academic Library Environments	Vrana (2025)
Competencies related to digital literacy	AI literacy education for students & library professionals to raise awareness about AI.	Chigwada (2024)
Global dimension	The function of libraries in developing countries. Religious groups and higher learning. (Tec. 5.0).	Barsha & Munshi (2024); Cahyono & Masruroh (2025)

This thematic mapping reveals that research encompasses a range of conceptual frameworks, practical AI adoption for discovery, ethics and leadership, user perception studies, and literacy development, with a growing emphasis on comparative/global insights. The intersection of artificial intelligence (AI), higher education, and digital libraries has been examined across conceptual, technological, and ethical dimensions. Steiger (2024) provides a comprehensive literature review outlining AI's influence on academic libraries, while Barsha and Munshi (2024) focus on prospects and challenges of AI in developing countries. Rahmanova (2025) extends this discussion by framing libraries as evolving institutions for education, access, and cultural preservation in the digital era. A significant amount of attention is devoted to information access and discovery. Chouia (2024) explores AI's potential to transform access and management of academic resources, while Shamsitdinova et al. (2024) demonstrate how AI enhances digital library searching, reshaping research practices. Meakin (2024) offers a critical perspective by examining how generative AI affects students' engagement with library resources, prompting questions about dependency and the value of resources.
Institutional readiness and leadership styles in adopting AI have also been studied. Shal et al. (2024) examined the role of leadership in AI acceptance, while Cahyono and Masruroh (2025) situated library transformation within the broader framework of Technology 5.0 in Islamic higher education. Complementing this, Sheppard and Mayton (2024) emphasize the importance of developing ethical policies, while Chigwada (2024) proposes AI-focused digital literacy training to enhance competencies among students and librarians. Exploratory studies such as Vrana (2025) provide evidence of varying perceptions and adoption rates of AI-supported tools in Croatia, highlighting contextual differences. Collectively, these works underscore that AI-enabled digital libraries are not merely service providers but strategic actors in shaping equitable, ethical, and innovative higher education ecosystems.

Scoping Review

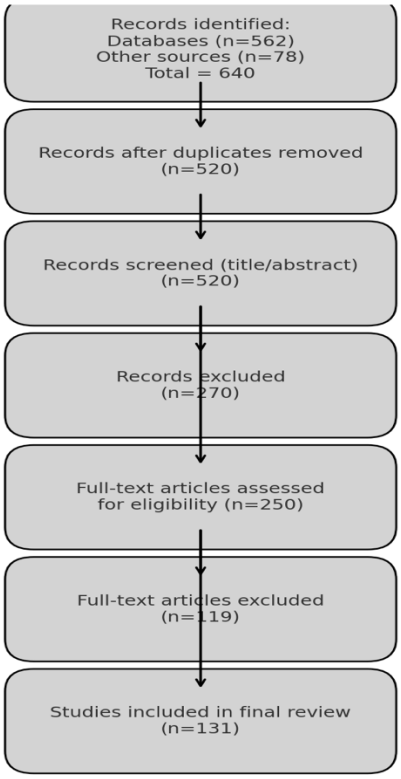
A scoping review has been conducted on the comprehensive list of references from 1 to 131, as it encompasses a broad spectrum of themes, including AI, Higher Education, Digital Libraries, Learning, Literacy, Ethics, among others. It was essential to categorize the references by theme for easy processing and interpretation. In a scoping review, it is not crucial to critically appraise all studies; rather, it is a matter of mapping the literature to some extent.

Review of AI in Higher Education and Digital Libraries

The widespread use of artificial intelligence (AI) in education has led to various research activities that harness the profound potential of AI in transforming higher education institutions and academic libraries. The research encompasses pedagogical and technical transformations in higher education institutions and libraries, with a focus on digital literacy and preparedness for AI adoption. The scoping review will highlight the existing research for the period 2019–2025.
PRISMA Flow (Scoping Review):

- Records identified:
- Databases (Google Scholar, etc.) = 562
- Other sources (e.g., conference/ Seminar papers, grey literature, and reports) = 78
→ Total = 640
- Total records after duplicates removed = 520
- Records screened (title/abstract) = 520
- Records excluded (not relevant, outside scope) = 270
→ Remaining = 250

- Full-text articles assessed for eligibility = 250
• Excluded full-texts (not AI focus, higher education/ library, insufficient data) = 119 → Remaining from 131
- Studies included in final scoping review = 131



PRISMA flow diagram for scoping review

It illustrates:

- records identified = 640 (from databases = 562 and from other sources = 78)
- After duplicates removed = 520
- Excluded at title/abstract screening = 270
- Assessed full-texts = 250
- Excluded at full-text stage = 119
- studies included in the final scoping review: 131

1. Learning Transformation and Pedagogical Innovations

The studies conducted by Adel et al. (2024), Cai et al. (2025), and Jeyakumaran et al. (2025) highlighted how AI tools are used to support adaptive learning for students in an optimized way as presented by the Zone of Proximal Development theory. The primary objective of the vast majority of the published papers has been to alter the way of learning (Bayly-Castaneda et al., 2024) by integrating AI technology in education. The implementation of AI technology in management

education (Ellikkal & Rajamohan, 2025) and ChatGPT technology for learning (Foroughi et al., 2025; Vargas-Murillo et al., 2023) has also been strengthened by other adoption research.

2. AI and Digital Literacy

Levels of AI literacy, engagement, and outcomes achieved by the learners. Digital literacy (Meakin, 2024; Singh et al., 2025) remains a concern. Baskara (2025), Chigwada (2024), and Rožman et al. (2025) have introduced models for AI literacy in their respective works. In these works, it is pertinent to note that AI literacy, as a mandate, is imperative for all learners (Akakpo, 2024; Hossain, 2025) and all librarians. They reveal in their works how librarians can acquire AI literacy for AI citizenship.

3. Academic Libraries and Digital Transformation

The escalation of libraries in the context of a significant mediator for AI implementation is brought into focus. AI has the capability to bring a paradigm shift in metadata tasks (Aithal & Aithal, 2023; Gürsen et al., 2023; Rathod, 2025), inclusivity, and digital strategies. The use of AI for searching and managing information (Shamsitdinova et al., 2024; Chouia, 2024; Narayanan, 2024; Vrana, 2025; Buitrago-Ciro et al., 2025) highlights the disruptive effects of Generative AI and Comparative and exploratory studies on the divergent levels of implementation worldwide.

4. Ethical, Policy Dimensions and Equity

Ethical matters are also widely discussed by Chen (2024), Holmes et al. (2022), and Sheppard & Mayton (2024). Ogunjimi (2024) and Hodonu-Wusu (2025) provide guidelines and argue against the inequality of AI-powered libraries, highlighting how they hinder originality. The use of AI as a means to diminish barriers between people of varying socio-economic statuses (Edeni et al., 2024; Goswami & Sharma, 2024) remains largely unexplored, despite having sufficient empirical support.

5. Institutional Readiness and Global Perspectives

Some studies examine institutional approaches (Alqahtani & Wafula, 2025; Pant et al., 2025; Potluri & Kilaru, 2025) for adopting AI and offer insights from India, Asia, and global contexts, focusing on concerns and hurdles in governance, infrastructural development, and faculty preparedness. Quy et al. (2023) and other global studies, such as Carvalho et al. (2022), study digital transformation models in Vietnam and worldwide. Comparative studies (Chen et al., 2024; Yu et al., 2025) highlight global observations and sentiments, underscoring a lack of readiness in different contexts.

6. Emerging Frontiers: Generative AI and Well-Being

Noroozi et al. (2024). Giannakos et al. (2025) and Wood & Moss (2024) have studied the implications for instruction and methodology regarding ChatGPT. Current research is exploring the new role assigned to generative AI. Shukla et al. (2024) examine the impact of AI on well-being, while Hmoud et al. (2024) investigate generative AI and its relationship to learners' motivation. Long-term psychological and sociocultural effects have yet to be fully investigated.

7. AI in Higher Education and Digital Libraries

Thematic Mapping Table

Theme	Representative Studies	Main Insights
Pedagogical Innovations	Adel et al. (2024); Cai et al. (2025); Jeyakumaran et al.	AI reshapes pedagogy via adaptive learning, ChatGPT integration, and lifelong learning; strong focus on short-term adoption.

	(2025); Vargas-Murillo et al. (2023)	
Digital & AI Literacy	Baskara (2025); Chigwada (2024); RoÅ¾man et al. (2025); Akakpo (2024); Hossain (2025)	AI literacy essential for students & librarians; mostly conceptual models, few standardized curricula.
Library Transformation	Aithal & Aithal (2023); GÃ¼rsen et al. (2023); Rathod (2025); Shamsitdinova et al. (2024); Chouia (2024)	Libraries as mediators of AI adoption: metadata, inclusive access, intelligent search. Adoption uneven across regions.
Ethics & Academic Integrity	Chen (2024); Holmes et al. (2022); Ogunjimi (2024); Sheppard & Mayton (2024); Hodonu-Wusu (2025)	Risks of plagiarism, bias, inequity; need for ethical frameworks. No global standards yet.
Institutional Readiness	Alqahtani & Wafula (2025); Pant et al. (2025); Quy et al. (2023); Chen et al. (2024)	Governance, infrastructure, and faculty readiness vary; adoption clustered in Asia.
Generative AI & Well-being	Noroozi et al. (2024); Giannakos et al. (2025); Shukla et al. (2024); Hmoud et al. (2024)	Generative AI impacts motivation, methods, and student well-being; long-term effects

The intersection of artificial intelligence (AI), higher education, and digital libraries has emerged as a transformative domain in recent years. Between 2019 and 2025, scholarship expanded rapidly, reflecting pedagogical innovations, the central role of libraries, and growing ethical and policy concerns. This scoping review presents findings synthesized from six major themes, thereby highlighting key trends and research gaps. AI is revolutionizing education through personalized solutions, as indicated by studies from Adel et al. (2024), Cai et al. (2025), and Jeyakumaran et al. (2025). Further work by Vargas-Murillo et al. (2023) are loosening the tethers of how student engagement and educational delivery methods are maintained with advances in AI. The necessity of AI literacy among educators and librarians (Baskara,2025; Chigwada,2024) is emphasized, with proposed frameworks and discussions on librarians' roles, yet there's a lack of empirical studies and validated curricula (Akakpo, 2024; Rožman et al., 2025; Hossain, 2025).

The adoption of AI is greatly facilitated in academic libraries. Studies are cited to demonstrate the impact of ChatGPT (Aithal & Aithal, 2023; Rathod, 2025) on services, digital strategies in India and the US, and improving productivity in research through AI tools (Shamsitdinova et al., 2024; Chouia, 2024). Inequalities in the adoption of AI across the world are discussed to emphasize (Vrana, 2025; Buitrago-Ciro et al., 2025) the significance of academic libraries. With the increasing use of AI, ethical issues are also emerging, with academic integrity and biased algorithms being scrutinized by Holmes et al. (2022) and Chen (2024). Models of inculcating ethics have been proposed by Ogunjimi (2024) and Sheppard & Mayton (2024), while Hodonu-Wusu (2025) examines the structural inequities inherent in AI. Although the lack of evidence of gain in equity has been elaborated on by Edeni et al. (2024), gaps in society are instead being filled by AI. This is due to a lack of preparedness in the institutional environment, as identified by Alqahtani & Wafula (2025) and Pant et al. (2025), where disparities in Asia are more noticeable (Quy et al., 2023; Chen et al., 2024). There are also more recent studies on the novel effects of generative AI. Noroozi et al. (2024), Giannakos et al. (2025), and Wood & Moss (2024) examine the instructional and methodological effects of tools such as Chat-GPT. There are also studies that connect the effects of generative AI to student motivation,

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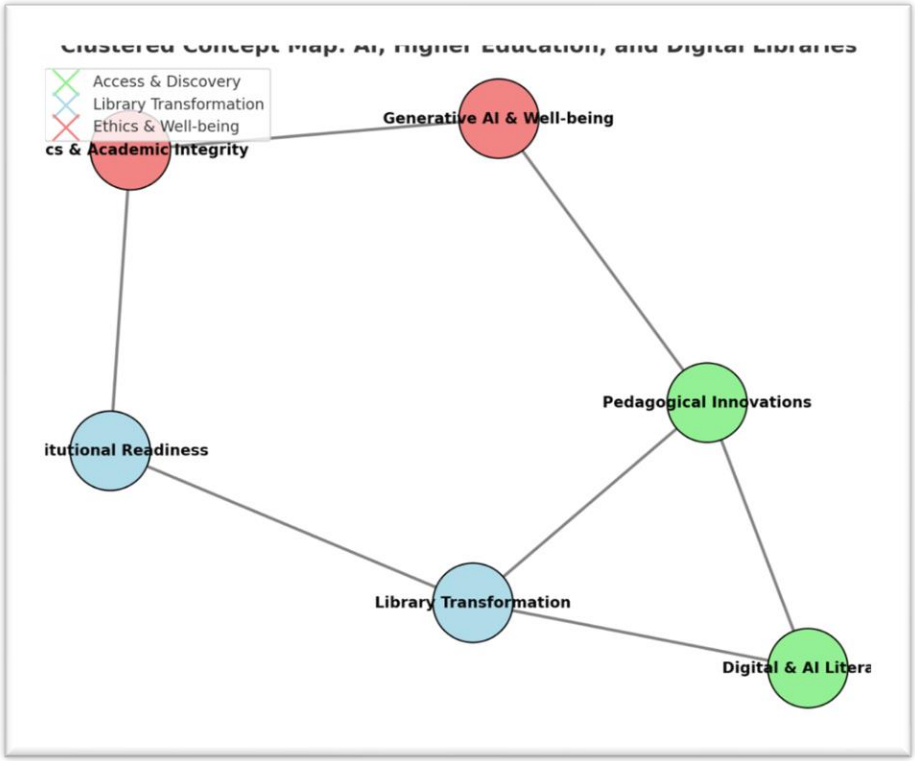
such as Hmoud et al. (2024), and the impact of AI on digital well-being, as explored by Shukla et al. (2024). There is limited research on the long-term psychological and sociocultural effects of AI.

Visual Concept Map

A visualization of the concept map between these six themes:
(Pedagogy ↔ Literacy ↔ Libraries ↔ Ethics ↔ Institutions ↔ Well-being)

A conceptual map of visuals connecting important themes is shown below, highlighting the key themes of AI, higher education, and digital libraries. These important themes are interlinked in a conceptual map of visuals, as shown below.



The clustered concept map:

- Access & Discovery → Pedagogical Innovations, Digital & AI Literacy
- Library Transformation → Library Transformation, Institutional Readiness
- Ethics & Well-being → Ethics & Academic Integrity, Generative AI & Well-being

This structure shows how themes are grouped yet interconnected across higher education and digital library contexts.

Gaps Identified

- Empirical Evidence: Most of the studies are conceptual/exploratory. Only a few are longitudinal or experimental studies.
- Models for AI Literacy: There is an absence of standard models in regions and subject areas to measure or teach AI literacy.
- Comparative Analysis: There are very few comparative evaluations that can be used in systematic assessments of adoption levels in various cultures and economic settings.

- Concern of Ethics and Policy: There is public concern about the issue; however, there is comparatively less consensus on enforceable policies that ensure academic integrity as an important consideration.
- Human Development and Well-being: Lack of evidence on the effects of the incorporation of AI in learning and the use of libraries on well-being and human development.

Conclusion

Research on AI, higher education, and digital libraries is a varied area, mainly focused on education and transformations within libraries. While ethical considerations are gaining attention, their impact is still somewhat underdeveloped. Future research should prioritize cross-national comparisons and explore the effects of Generative AI. The literature demonstrates that AI is rapidly transforming higher education and digital libraries, with particular momentum in pedagogy, literacy, and library services. However, much of the research remains conceptual, exploratory, or context-specific. To advance the field, future scholarship should prioritize longitudinal evidence, globally comparative frameworks, and interdisciplinary approaches that integrate ethics, policy, pedagogy, and well-being.

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