

A Modern Approach to Developing Academic Libraries by Using Artificial Intelligence Tools

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Abstract: *The field of Library and Information Science (LIS) has undergone a significant transformation with the emergence of Artificial Intelligence (AI), which has enhanced library operations, services, and user experiences. AI contributes to improved user satisfaction by streamlining access to information resources and equipping librarians with advanced tools, such as ChatGPT, Elicit, Research Rabbit, Scite.ai, Consensus, ScholarAI (ChatGPT Plugin), Paperpile / Zotero / EndNote, and Connected Papers, etc., for collection management, information retrieval, and data-driven decision-making. Furthermore, AI enables the analysis of user behaviour and usage trends, supporting optimised resource allocation and more strategic approaches to collection development.*

Keywords: AI in Libraries, Digital tools, User Behaviour Analysis, Information Retrieval, Collection Management

1. Introduction

Artificial intelligence (AI) is a technology that enables computers and machines to simulate human abilities such as learning, comprehension, problem-solving, decision-making, creativity, and independent action.

AI-enabled applications and devices can recognise and interpret objects, understand and respond to human language, and learn from new information and past experiences. They can generate detailed recommendations for users and experts, and in some cases act autonomously - reducing or even eliminating the need for human intervention. A classic example of this autonomy is the self-driving car. [1]. The most powerful applications of AI for libraries lie in **descriptive AI**, which transforms diverse collection materials - such as photos, videos, audio recordings, and manuscripts - into machine-readable data using techniques like computer vision and speech-to-text. This enables large-scale, automated description of resources, significantly improving information retrieval.[2]

Librarians and AI are increasingly intertwined in the educational landscape, creating new opportunities to enhance teaching, learning, and research. Key aspects of this relationship include:

1. Supporting Research and Learning

AI-driven tools assist students, educators, and researchers by offering advanced search functionalities, personalised recommendations, semantic search, and automated data analysis. These capabilities streamline information retrieval, enabling users to navigate vast academic resources more efficiently. Here we can use the following AI Tools,

1. **Elicit** [3] – AI literature review assistant for research papers. Practical step-by-step guide for how to use Elicit to help a researcher (from first-time setup through producing exportable results). I've included short tips, example prompts you can copy, and notes on verification & limitations.

1) Get started (account + choose a workflow) [3]

1. Create a free account at Elicit or log in.
2. On the Elicit home page, pick the workflow that matches your stage:

- **Find Papers** - Quick semantic search across papers.
- **Research Report** - Synthesise answers across many papers.
- **Systematic Review** - Guided screening, extraction, PRISMA output.
- **Upload & Extract** - Upload PDFs and auto-extract data.
- **Chat with Papers** - Conversational Q&A over selected papers.
- **Create an Alert** - Get notified about new papers on a topic.

2) Write a clear research question [3]

- Use natural language (full question, not just keywords). Example:
 - “What are the effects of daily screen time on adolescent sleep duration in randomised trials?”
 - “What interventions reduce hospital readmissions within 30 days after heart failure discharge?” Elicit will refine or suggest angles once you enter the question.
 - Find and gather papers (semantic search + add your own)

1. Run Find Papers with your question. Elicit uses semantic search (so it finds relevant work even if keywords differ). Review the returned papers; star / add the ones you want to your Library. If you have specific PDFs or results, use Upload & Extract to pull structured fields automatically. 4) Screen titles & abstracts (especially for reviews)

- Use the Systematic Review workflow to auto-suggest screening criteria from your research question (you can edit/add criteria from your protocol). Elicit will score papers against specific criteria and expedite screening. Export the screened set (and track inclusion/exclusion).

5) Extract data and summarize [3]

1. Choose or create extraction fields (e.g., sample size, outcome measures, effect sizes, study design). Elicit can auto-extract many structured fields from papers or PDFs. Manually check extracted values against the paper (always verify AI extraction). Tip: sample-check 10–20% or all critical fields for high-stakes work. Guidance docs show how to edit and correct extracted cells.

6) Synthesize evidence & make a report [3]

- Use the **Research Report** or the Systematic Review report generator to create:
 - Summaries of included studies,
 - A mini-PRISMA flow diagram,
 - Tables and frequency counts,
 - Sentence-level citations to source paragraphs. Elicit can summarize groups of papers and produce draft write-ups - but you should edit for tone, accuracy, and interpretation.

7) Export, cite, and manage references [3]

- Export extracted tables (CSV/Excel) for meta-analysis or spreadsheets.
- Export references to reference managers (e.g., Zotero) or copy citations for your manuscript. Use exported tables as the basis for figures or meta-analytic calculations.
- 8) Verify, validate, and document reproducibility
- **Verify:** AI can mis-extract or misinterpret - always crosscheck critical numbers and claims with the original PDFs.
- **Document:** Keep a clear search strategy, screening criteria, and export snapshots so your search is reproducible. Elicit's Systematic Review workflow is designed to help with these steps.
- 9) Practical prompts & examples you can paste into Elicit
 - "Summarize the main findings and effect sizes for each included trial".
 - "Extract sample size, intervention, control, primary outcome, follow-up time for these papers into a table".
 - "Generate a short methods paragraph describing my search and screening steps".
- 10) Tips, limitations, and best practices
- **Strengths:** fast semantic search, large paper coverage, automated extraction and screening workflows that save time. Limitations: Elicit is not perfect - extraction errors and missing papers are possible. AI outputs are aids, not substitutes for domain expertise; for high-stakes systematic reviews or clinical guidelines, run validation steps and consider multiple databases/methods. Independent evaluations and library guides note both utility and limits.
- **Privacy & licensing:** check Elicit's policies if you upload unpublished or sensitive documents. Use it alongside traditional database searches (PubMed, Web of Science) for completeness. Here is the other tools which can be useful for research support,

- **Research Rabbit** – Visual mapping of academic research networks.
- **Scite.ai** – Checks paper citations and credibility.
- **Consensus** – Answers questions from scientific papers.
- **ScholarAI (ChatGPT Plugin)** – Finds and summarizes academic research.
- **Paperpile / Zotero / EndNote** – Reference management with AI features.
- **Connected Papers** – Discover related academic work visually

2. Promoting Digital Literacy

Librarians play a central role in developing AI literacy across campuses. They teach students and faculty how to use AI tools effectively and responsibly, emphasizing both the strengths and limitations of AI systems. This includes guidance on evaluating AI outputs, protecting privacy, and identifying misinformation generated or amplified by AI.

Enhancing Information Literacy [7]

How AI supports this: Elicit / Consensus / Scite.ai → Teach users how to search effectively, evaluate credibility, and identify reliable sources. Google Bard / ChatGPT → Summarize complex content, compare information, and reduce misinformation.

Digital literacy skills gained:

- Smart searching
- Source evaluation
- Citation proficiency

A. Developing Data Literacy AI can turn raw data into insights easily. [5]

Tools: ChatGPT / Excel AI / Tableau AI → Explain graphs, clean data, generate visualizations.

Skills learned:

- Reading charts
- Basic data analysis
- Interpreting trends

B. Strengthening Digital Communication Skills [6]

AI tools can guide users in writing, editing, and creating digital content.

Tools:

- Grammarly / QuillBot / ChatGPT → Improve writing clarity.
- Canva AI / Adobe Firefly → Create presentations, posters, videos.

Skills gained:

- Professional writing
- Visual communication
- Design literacy

C. Boosting Creativity & Media Literacy

AI tools help students and educators create videos, images, podcasts, and presentations.

Tools:

- **Canva AI / Adobe Express / Lumen5** → Quick content creation.
- **Deepfake detection tools** → Teach media authenticity.

Skills developed:

- Recognizing fake information
- Creating ethical media
- Using creative tools

Practical Strategies to Increase Digital Literacy Using AI [4]**For Schools and Colleges:**

- Introduce AI-assisted digital literacy modules.
- Train teachers to use AI tools.
- Provide guided workshops on search, writing, and critical thinking tools.

For Libraries

- Conduct AI tool awareness programs.
- Provide access to research AI tools.
- Teach responsible AI usage and citation methods.

AI tools increase digital literacy by helping users:

- Find credible information
- Evaluate sources
- Write and communicate effectively
- Understand data
- Create multimedia content

3. Developing Educational Resources

Libraries are evolving into hubs for AI-related learning. Librarians design workshops, tutorials, guides, and online modules that help users understand and leverage AI for academic and professional purposes. These resources empower learners to integrate AI tools into research workflows and creative tasks.

Artificial Intelligence (AI) is transforming how educational resources are created, customized, and delivered. By integrating AI tools in educational design, teachers and institutions can produce highly engaging, adaptive, and efficient learning materials.

1. Automated Content Generation [10]

AI tools such as large language models (LLMs) can generate:

- Lesson plans
- Study guides

- Summaries of complex concepts
- Quiz banks and exam questions

This significantly reduces educators' workload and helps maintain consistent quality across materials.

Example:

ChatGPT or Google Gemini can generate explanations tailored to different grade levels (basic, intermediate, advanced).

Benefit:

Faster resource development with high customization possibilities.

2. Personalized Learning Materials [10]

AI algorithms analyze learner data - performance, preferences, and behavior - to create personalized content. Examples include:

- Adaptive reading materials
- Customized assignments based on difficulty level
- Tailored feedback for each learner
- This increases engagement and supports differentiated instruction.

3. Intelligent Tutoring Systems (ITS) [10]

AI-powered tutoring systems provide:

- Real-time hints
- Step-by-step scaffolding
- Instant grading
- Learning analytics

These systems help students learn at their own pace outside the classroom.

4. Enhancing Digital Learning Objects [9]

- AI can help design:
- Interactive simulations
- Virtual labs
- Gamified modules

Voice-based learning materials for accessibility. Computer vision, natural language processing, and speech recognition enhance the usability and inclusivity of digital resources.

5. Supporting Teachers in Curriculum Development [8]

AI tools help educators:

- Map learning outcomes to content
- Align assessments with Bloom's Taxonomy
- Identify resource gaps in a curriculum
- Update educational materials based on the latest research

- Systems like Elicit or Scite.ai assist teachers in integrating evidence-based information.

6. Translation and Accessibility [9]

AI-powered translation and text-to-speech tools enable:

- Multilingual educational content
- Inclusive materials for visually impaired and hearing-impaired learners
- This supports equitable learning environments.

4. The Ethics and Risks of Developing Artificial Intelligence: [11]

Librarians contribute to critical discussions about the ethical implementation of AI in educational settings. They advocate for transparency, fairness, and accountability in AI systems, ensuring that concerns related to algorithmic bias, data privacy, surveillance, and equitable access are recognized and addressed.

All scientists and engineers must consider ethical questions related to their professional activities - such as how they should act on the job, which projects should or should not be undertaken, and how such projects should be responsibly managed. As discussed in the *Handbook of the Ethics of Computing* (Berleur and Brunnstein 2001), the field of Artificial Intelligence introduces several ethical concerns that extend beyond traditional engineering challenges like ensuring that bridges do not collapse. AI raises additional issues, including:

- The potential loss of human jobs due to automation.
- A shift in how people experience leisure time - either too much or too little.
- A diminished sense of human uniqueness as machines replicate cognitive tasks.
- The misuse of AI systems for harmful or unethical purposes.
- A reduction in human accountability when decisions are delegated to AI.
- The possibility that highly advanced AI could pose existential risks to humanity.

Importance of AI in Library Development: [14,15,16]

Artificial Intelligence (AI) is transforming libraries from traditional information centers into intelligent, interactive, and user-centered knowledge hubs. AI plays a crucial role in improving library services, operations, resource management, and user experience.

1. Enhances Information Retrieval

AI-powered search engines, chat bots, and discovery tools help users find accurate information more quickly.

- Natural language processing (NLP) improves keyword and subject searching.
- Recommendation systems suggest books, articles, or e-resources based on user behavior.

Example: AI-based OPAC systems that understand user queries in plain language.

2. Supports Digital Library Expansion

AI enables digitization, organization, and accessibility of large collections.

- Optical character recognition (OCR) converts printed materials into searchable text.
- Computer vision helps tag images, manuscripts, and historical documents.

This increases the visibility and usability of library resources.

3. Improves Library Management

AI tools help librarians with:

- Automated cataloging and metadata generation
- Predicting book demand
- Streamlining acquisitions
- Optimizing circulation and shelving

This reduces workload and supports data-driven decision-making.

4. Personalizes User Services

AI provides personalized learning and reading experiences.

- Recommender systems show resources tailored to individual interests.
- Personalized dashboards track user progress and reading habits.

This enhances user satisfaction and engagement.

5. Strengthens Reference and Information Services

AI chatbots and virtual assistants offer:

- 24/7 reference support
- Quick answers to FAQs
- Guidance for database searching and research

This increases the library's accessibility and service availability.

6. Supports Research and Scholarly Communication

AI tools assist researchers with:

- Literature reviews (Elicit, Research Rabbit)
- Citation analysis (Scite.ai)
- Plagiarism checking
- Data visualization

Libraries can integrate these tools to strengthen research support services.

7. Enhances Preservation and Archiving

AI helps maintain long-term digital archives:

- Detecting deterioration in digital files
- Predicting file obsolescence
- Automating migration to new formats

AI thus supports sustainable digital preservation.

8. Improves Accessibility and Inclusion

AI-powered tools help libraries serve diverse users:

- Text-to-speech and speech-to-text
- Translation into multiple languages
- Assistive reading technologies for visually impaired users

This creates an inclusive learning environment.

9. Enables Smart Library Infrastructure

AI is central to the development of intelligent library spaces:

- Automated security systems
- Smart shelves that detect misplaced books
- Usage analytics for space planning

These innovations improve operational efficiency.

5. Conclusion

AI is reshaping libraries by improving access, efficiency, personalization, and innovation. Libraries that adopt AI are better equipped to meet the changing needs of 21st-century learners, researchers, and communities.

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