Conversational AI Chatbots in library research: An integrative review and future research agenda

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Abstract

The growing role of conversational AI Chatbots continues to change the library and information service landscape. Chatbots are replacing some of the library services that humans conventionally perform. In the era of instant evolution of artificial intelligence (AI), the role of Chatbots in libraries keeps expanding and acquiring more experience. This paper aims to examine the extant research on library Chatbots using an integrative literature review (ILR) approach. Empirical and non-empirical papers from the Scopus database to ascertain what is already known about the topic. Forty papers (articles and conference papers) were scrutinized for further analysis. The leading emergent themes in the literature were (1) The evolution of Chatbots technology in libraries, (2) Antecedents for Chatbot use in libraries, (3) User experience with Chatbot use in libraries, (4) Chatbot use in libraries amidst COVID-19, and (5) Challenges facing Chatbot use in libraries. Research on Chatbots in library services is still embryonic and has only begun to flourish. Nevertheless, there is still a significant research gap despite its surging curve. The findings of this integrative review contribute to the body of knowledge on the nexus between artificial intelligence and library operations. It also furnishes academics and practitioners with six potential directions for future research opportunities.

Keywords

Artificial intelligence, Chatbots, conversational agents, integrated review, library services, user experience

Introduction

Scholars' interest in studying the application of Chatbots in the library context is undergone notable recognition in recent years wherein the use of artificial intelligence (AI) and associated technologies (e.g. "machine learning," "big data," "natural language processing," "internet of things," "virtual reality," "cloud computing," and "robotics") have unlocked opportunities for cross-organizational application integration and intelligent information services in networked environments (Cox and Mazumdar, 2022; Noh, 2023).

Though no widely acknowledged definition of Chatbots is frequently in use, it has been recently delineated in the artificial intelligence and information science literature as "intelligent conversational applications that can simulate natural language conversation by engaging in text or voice or both) input and output exchange with humans" (Borsci

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et al., 2022: 95). Written messages, navigation controls and keys, and computer-generated voices are examples of interaction modes used in Chatbots to communicate with users using the language they understand (Suhaili et al., 2021). As such, libraries are entailed to establish knowledge bases with insightful user interaction and inquiries being processed by intelligent Chatbots, which are designed to perform simple tasks like processing requests and more complex tasks such as offering advice within a specific specialization context (De Cicco et al., 2021).

Scholars have shown that Chatbots can enable libraries to seize the time and distance to extend user support by promoting and advertising library services and facilities. Chatbots can support immediate interaction by handling frequently asked questions and predictable queries in a user-friendly format (Allison, 2012). They are particularly adept at improving accessibility and work efficiency by performing routine and repetitive tasks, which can relieve librarians from the burden of answering the most common inquiries (Mckie and Narayan, 2019). Chatbots can also boost users' experience through a direct conversation that does not require users to be familiar with the website layout or navigation process. Furthermore, extant research has demonstrated that integrating Chatbots into online service settings seems to drive idea generation and innovative decisions (Goli et al., 2023; Saba et al., 2021).

Despite the significant benefits of Chatbot applications in library settings, risks still challenge their swiftly evolving modality in the complex landscape of library and information services (Hamad et al., 2023). Although Chatbot research is becoming more ubiquitous, there has been no review concerning recent trends, challenges, and imminent research prospects of their application in library settings. In contrast, recent reviews on Chatbots have mainly focused on healthcare (e.g. Wilson and Marasoiu, 2022) and education (e.g. Hwang and Chang, 2023) settings.

Purpose of the study

This integrative review aims to synthesize and explore research on Chatbot applications in a library setting, which can guide future research directions. Therefore, the following questions are proposed:

1. RQ1: How has Chatbot technology evolved in library settings over time?
2. RQ2: What are the antecedents influencing the adoption and usage of Chatbots in libraries?
3. RQ3: How do users perceive and experience using Chatbots in library interactions?
4. RQ4: In what ways has the use of Chatbots in libraries been affected by the COVID-19 pandemic?
5. RQ5: What challenges are encountered in implementing and utilizing Chatbots in library contexts?
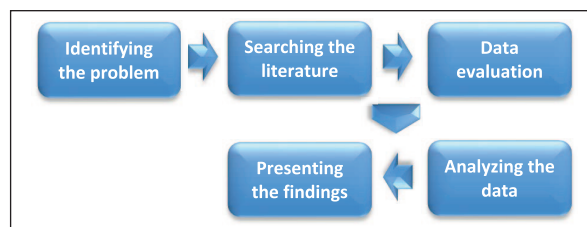

Figure 1. ILR model.
Source: Authors' own work.

This paper is organized into six main sections: (a) Method, (b) research findings, (c) discussion, (d) implications for future research avenues, (e) limitations, and (f) conclusion.

Method

The integrative literature review (ILR) approach (Callahan, 2010; Torraco, 2016) was applied as the principal lens to explore and synthesize diverse streams in library Chatbot research. The ILR is a distinct form of research that summarizes existing evidence to develop novel knowledge about a particular phenomenon or an emerging field (Klarin and Suseno, 2023). The IRL is essential in demonstrating that new understanding is spawned from existing research knowledge. According to Cronin and George (2023), a "thorough and well-written integrative review synthesizes the current state of knowledge of a topic and brings together different conversations" (p. 168). Following Whittemore and Knafl (2005), the paper followed A five-step ILR model (see Figure 1) to attain the purpose of the study.

Phase 1: Identifying the problem

Given the vital role of Chatbots in library settings, a considerable amount of research exists on the phenomenon in question. However, leading emergent themes in the literature are not well synthesized to guide future research opportunities in that intersected domain.

Phase 2: Searching the literature

The literature search step consisted of four funneled queries (see Figure 2). The first query focused on "library" or "libraries" in the Title, Keywords, or Abstract sections. This query resulted in 526,149 papers. The second search query searched within these papers to narrow the first query down to those that were related to "Chatbot(s)," "virtual assistant," "digital assistant," "interactive agents," "robotic assistant," "artificial intelligence AND bot," or "conversational agent(s)" in the Title, Keywords, or Abstract sections. This query yielded 208 papers. The papers in the third round were further filtered based on inclusion/exclusion criteria involving the language used
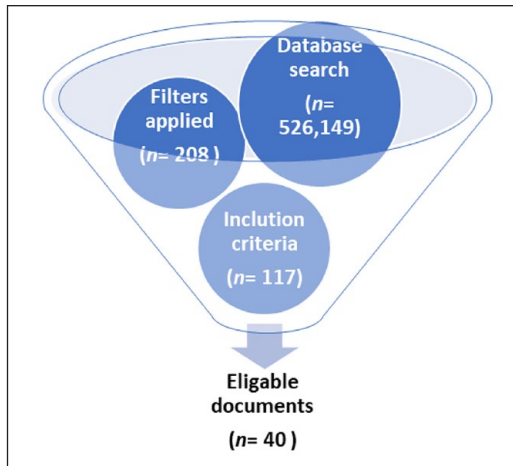
Figure 2. Screening process.
Source: Authors' own work.

(English) and the paper type (Journal article or conference paper). Hence, notes, erratum, letters, books, editorials, book chapters, surveys, presentations, dissertations or theses, commentary, articles without abstract or author, and non-English language papers were ruled out. The last search query returned 117 papers reserved for further qualitative securitization. Seventy-seven papers were excluded as their titles or abstracts were irrelevant or had no potential. The final screening round retained 40 papers for the review panel.

Phase 3: Data evaluation

Forty papers were selected for inclusion in this integrative review. Content analysis was performed to identify and organize the selected papers on five domains: research aim, design, findings, implications, and gaps. Content analysis is a method utilized to ascertain the occurrence of specific concepts and thoughts within the paper by analyzing the prevalence, denotation, and associations of concepts, then developing inferences concerning the insights within the paper to unveil conclusions (Brown et al., 2020; Duan et al., 2020). Table 1 presents the extant research on Chatbot use in libraries. It shows that most research was conceptual or exploratory, following a qualitative case study approach wherein the researchers used interviews or documentation as the primary data source. A technical experimental research approach followed this, while the remaining papers followed a mixed methods strategy. The table also shows that researchers' interest in Chatbot use in libraries has evolved over the past 17 years (2006–2023), wherein an evident mounting trend can be identified. The development withstands two phases. The first phase is *the discovery phase*, which witnessed a sluggish start, with eight papers in 12 years between 2006 and 2018 (0.67 papers/year). The second phase is a *booming phase* (2019–2023),

which witnessed an upsurge in the quantity and variety of library Chatbot research, with 32 papers in 4 years (4 papers/year) accounting for nearly 80% of all papers since 2006. This growth can be attributable to the advances in Chatbot technology over the last 5 years and the development of library systems that can be integrated with Chatbot applications. Figure 3 illustrates the research timeline on Chatbots utilization in libraries from 2006 to 2023.

Phase 4: Analyzing the data

In this phase, the authors conducted a thematic analysis of the papers following six steps:

1. The familiarization stage, wherein the selected papers were initially explored and reviewed.
2. The coding stage in which key phrases describing the content in the texts were highlighted.
3. The theme generation stage is based on the identified codes to reflect patterns found in the literature, considering that the results may include surrogate terms such as "virtual library," "e-library," and "online library."
4. Thematic review wherein generated themes were checked for their accuracy and representation of the included literature.
5. Theme labeling as the authors labeled each theme based on its content.
6. Writing up as the authors delineate and deliberate the findings of the integrative review

The authors employed an inductive approach to thematic analysis, allowing the data to generate themes as previously explained. As a result, five themes have emerged concerning Chatbots in library research involving (1) The evolution of Chatbots technology in libraries, (2) Antecedents for Chatbot use in libraries, (2) User experience with Chatbot use in libraries, (4) Chatbot use in libraries amidst COVID-19, and (5) Challenges facing Chatbot use in libraries. Figure 4 illustrates the thematic framework.

Research findings

The findings of the integrative review of Chatbots in library research are presented and reflected upon in this section as follows:

Theme 1: Chatbot technology evolution in libraries

The evolution of Chatbots in libraries can be traced back to the mid-2000s when libraries began testing automated chat services to provide 24/7 assistance to users. However,

Table I. Research on Chatbot use in libraries.

Author(s)	Research aim	Research design	Findings	Implications	Research gap
Adetayo (2023)	Investigating AI Chatbots in libraries and their drawbacks	Conceptual	ChatGPT improves library services, but must be considered as a supportive tool rather than substituting librarians	ChatGPT can enhance library services, but its limitations and risks must be considered	Exploring the effectiveness of complementary versus obligatory ChatGPT.
Aditya et al. (2022)	Analyzing the previous works of Chatbot implementation in library portals	Review	Chatbots can augment user's experience, but face implementation challenges such as technical understanding and efficiency	Chatbots support student portal users and improve their access to information and resources	More reviews are required to examine the effectiveness of Chatbots, challenges and best practices in other educational settings
Ahad et al. (2007)	Incorporating digital avatars into the library setting to enhance experiences of users	Case Study of McLuhan Documentation Center, Germany	Neva, a kiosk information system, uses RFID and Haptek animation for personalized, user-friendly experiences based on interests.	The use of virtual human characters in libraries for personalized user experience	Lack of exploration in the use of virtual human characters in libraries
Ali et al. (2020)	Assessing AI applications in Pakistani academic libraries	Qualitative interviews with 10 chief librarians	Although librarians are knowledgeable about AI services that utilize natural language processing (NLP), they have minimal familiarity with Chatbots and robotics.	To establish AI Labs, libraries in Pakistan could team up with computer departments in their respective educational institutions.	Forthcoming work could explore social and ethical implications of AI adoption in libraries, such as privacy concerns, bias, and job displacement..
Allison (2012)	Describing a Chatbot designed to respond to inquiries regarding the library resources available at the University of Nebraska-Lincoln.	Case study of users of the University of Nebraska	The bot provides a 24/7 service that is consistent, enhances user engagement, and replaces complicated navigation systems.	There is a limited information in library research regarding Chatbot applications.	Further research on various Chatbot designs and functions in library setting is required.
Bagchi (2020)	Conceptualizing A Chatbot in a library that utilizes a conversational AI platform that is available for public use.	Conceptual	The technology framework that supports Rasa Stack utilization to create a library Chatbot.	The proposed Chatbot can improve library services for patrons.	Focusing on non-technical underpinnings for implementing Chatbots in libraries.
Behan and O'Keeffe (2006)	Developing "LUCAS" as a robotic assistant in a library environment and social interaction.	Description of the mobile robotic assistant development	The mobile robotic assistant "LUCAS" was able to perform its duties efficiently and socially interact with individuals.	The development of mobile robotic assistants to assist individuals in various environments.	The effectiveness of mobile robotic assistants in long-term usage and how it may impact human interactions.
Brown (2022)	To investigate the gender representation of Chatbots in academic libraries and the potential for feminist and gender-inclusive design.	Cross-sectional descriptive study in the United States	Few academic library Chatbots are gendered, indicating a departure from stereotypically feminine and patriarchal representations of digital assistants.	The study highlights the potential for feminist and gender-inclusive design in Chatbots and other AI applications.	The study focuses only on academic libraries in the USA and does not explore the influence of gendered AI in other contexts.
Černý (2023)	To explore Chatbot design without AI in education	Survey of 79 student users	Students interacting with Chatbots without AI awaits comparable mental and interactive reactions as those of a human being.	Provides suggestions for designers and AI vendors for more efficient and personalized Chatbots.	The study did not explore the impact of Chatbots on students' learning outcomes.

Table 1. (continued)

Author(s)	Research aim	Research design	Findings	Implications	Research gap
Chen (2023)	To test ChatGPT's performance in library reference services and compare it with traditional library Chatbots.	Experimental	ChatGPT provided better answers than traditional Chatbots, indicating the impact of AI in library services.	Lessons can be learned from previous transformative technology changes such as Google and Web 2.0.	More research is needed to identify the areas where ChatGPT may still struggle.
Cheung et al. (2020)	Understanding value chain of library management	Case study	Restricted collection, incompatible platforms, and constrained hours were the main problems for visually impaired people. AI-based Chatbot is a good solution.	The study highlights the chain analysis for library management and provides suggestions for successful services for visually impaired users.	Insufficient studies focus on library resources and services for visually impaired users.
Dube and Jacobs (2023)	Extending library services due to COVID-19.	Explanatory research using online questionnaires and interviews in South African libraries.	During the COVID-19 pandemic, remote users were assisted through a combination of conventional technology and innovative AI applications. BOTSA, a Chatbot was designed to help users quickly obtain responses to questions related to the library.	Adequate responses to the requirements of users during and after the COVID-19 period has resulted in the effective provision of comparable services and information access to remote users as it was before the onset of the pandemic.	Exploring further AI role in improving library services during and after crises and disasters.
Ehrenpreis and DeLooper (2022)	Describing the execution of a library Chatbot and its effect on user experience	Case study	The Chatbot aided individuals inquiring for information and furnished librarians with an understanding of the types of subjects that students explore through the library's online platform.	Chatbots enhance user experience and provide valuable insights to librarians.	Understanding the long-term impact of Chatbots on user behavior and satisfaction.
Griol et al. (2017)	Introducing a mobile learning app that combines Android app programming features using a modular design.	A Case study using a practical m-learning application	The design focuses on managing interactions and being aware of context, and promoting adaptability, durability and maintainability for users.	Offering a method to link a multimodal interface with mobile devices to enhance educational apps in mobile devices with intelligent communication capabilities.	The study does not focus on the impact of the presented m-learning application on student learning outcomes.
Griol et al. (2016)	Employing conversational agents that are sensitive to library communication Context	Case study	The proposed architecture integrates Android APIs to provide a robust application that is easily updatable and adaptable to users.	The study highlights the need for strategies for developing multimodal interfaces for smart mobile devices that identify and answer users' needs in a specific context.	The paper does not discuss the limitations or challenges of implementing context-sensitive multimodal conversational agents in library services.

Table 1. (continued)

Author(s)	Research aim	Research design	Findings	Implications	Research gap
Hranchak et al. (2022)	Uncovering students' mobile activities and identifying main components of library mobile services.	Online survey of 74 participants from USA and 89 participants from Ukraine	Library mobile services should include knowledge service via mobile media and use Chatbots to extend contemporary library services.	Other information institutions can use the findings to improve their informational mobile service.	Limited focus on users in specific college's major. Research is needed to identify user needs and preferences in different cultural contexts.
Hulliyah et al. (2021)	To create a WhatsApp Chatbot that can be used as a new alternative for da'wah (teaching people about Islamic values) and simplify the public's access to information about Islamic studies.	Experimentation of implementation of a WhatsApp Chatbot	The WhatsApp Chatbot was able to provide automatic replies and simulate conversations with users, making it an effective alternative for da'wah and information dissemination.	The use of Chatbots in various fields and how it can impact information dissemination.	The limitations of using Chatbots for complex conversations and how to improve its capabilities.
Jange (2015)	Developments in academic library services for professional excellence practices	Literature review and case study	Libraries have shifted from print to electronic media, emphasis is on access rather than acquisition. Innovative practices and services include the use of 3M security, Chatbots, and RFID.	Libraries need to continuously update their services and skills to keep up with changing information industry and user requirements.	Empirical research should test the effectiveness of the innovative practices and services proposed.
Jearanaiwongkul et al. (2021)	Comparing mobile and Chat apps to propose comparative metrics for libraries	Comparative case of various information domains	The development benchmarking (cost, time, and usability) metrics for a mobile Chatbot were examined and compared.	Assisting libraries in resource planning and selecting the best platform to meet the needs of their users.	Exploring the trade-offs between mobile applications and Chatbots in other domains beyond academic libraries.
Kaushal and Yadav (2022)	Exploring the potential threats and obstacles associated with implementing Chatbots in educational libraries.	Qualitative study using interviews and content analysis of library staff, PhD students, and faculty	Stakeholders favored Chatbots in academic libraries as they deliver diverse services and help in research. Yet, there are high perceived risks related to privacy intrusion and task complexity.	Chatbots enhance the quality of services offered by academic libraries, but Chatbot developers must address concerns related to privacy intrusion and task complexity.	Investigating the effect of Chatbots on user experience and engagement in other types of libraries.
Lin et al. (2021)	Investigating various approaches to enhance the engagement of senior citizens with Chatbots for educational purposes.	Experimental study of 30 users	Implementing approaches to handle errors can be advantageous for elderly individuals as they interact with robots, helping them achieve higher levels of efficiency and satisfaction	Findings broaden the scope of Chatbot research by examining communication errors that occur during human-robot interactions.	The study's sample size is limited, and it does not investigate how different types of Chatbots may be affected by various error-handling techniques.
Loveys et al. (2020)	Assessing how various design characteristics impact the quality of Conversational Agents (CAs).	Review	The study enables the identification of successful design features and a scientific framework for enhancing CAs in healthcare and other fields.	Design features such as personalized and responsive behavior, human-like appearance, and natural language contribute to better relationship quality with CAs.	Grasping the techniques to develop ECAs that are compelling and effective for all users.

Table 1. (continued)

Author(s)	Research aim	Research design	Findings	Implications	Research gap
Lund and Wang (2023)	Providing an overview of ChatGPT and its underlying technology, GPT, and to discuss its impact on libraries.	Qualitative interview	ChatGPT can improve library services. Ethical considerations, such as privacy and bias, need to be considered.	ChatGPT can be used responsibly and ethically to advance academic and librarianship work, but professionals must work alongside it to prevent abuse or being abused.	Further research on ChatGPT effectiveness and ethical issues in library services is required.
Mallikarjuna Rao et al. (2022)	Proposing a Chatbot for addressing college-related inquiries	Experimental web application that uses natural language processing	The Chatbot is designed to furnish details about admission processes, available courses, fee structures, placement statistics.	Librarians should plan for convenient application of Chatbots for customers to get information about colleges.	Additional research is required to study the benefits and drawbacks of this experimental approach.
Mckie and Narayan (2019)	Investigating the role of Chatbots to enhance the research activities in colleges	Conceptual	The article suggests that professionals in the field of information must incorporate new technologies like Chatbots to enhance, progress, and assist library services.	Collaborating with technology to interact with the conversational library Chatbot is crucial for developers to ensure it is user-friendly, customizable, and beneficial for students.	Further exploration of a sustainable technical solution is required. Also, collaboration between professionals and developers is overlooked.
Nawaz and Saldeen (2020)	Applying AI Chatbot applications to library reference services	Review and exploration	AI Chatbots increase commitment and engagement of students with academic library services.	Utilization library Chatbots improve reference services, increase efficiency, and provide personalized support for users	Challenges and limitations of using AI Chatbots in academic libraries rather than the Bahraini context.
Panda and Chakravarty (2022)	Demonstrating an AI-driven solution that is implemented as a InfoBot	Case study using the AI Chatbot service	Providing virtual assistance through AI Chatbots, libraries can enhance their reference service and introduce a new dimension to virtual reference services that can be relied upon.	The study highlights the exceptional benefits of AI Chatbots	There is currently no specific research that examines the unique advantages of AI Chatbots in libraries, particularly in relation to the recent pandemic.
Panda and Kaur (2023)	Exploring the possibility of ChatGPT systems as a substitute for conventional Chatbots in libraries.	Qualitative interviews	ChatGPT systems offer a practical substitute for knowledge base-driven Chatbot systems, which have the potential to offer users more precise and customized answers to their queries, while also reducing the workload.	There is a requirement for a significant amount of training data, as well as the potential danger of perpetuating prejudices.	Limitations and ChatGPT effectiveness in real-world settings necessitate more research.
Parkar et al. (2021)	Maintaining a web-based Chatbot to provide information and answer queries related to college education using AI and NL processing.	Web application development	The Chatbot can simulate human conversations, answer queries related to college courses and provide information on the academic calendar 24/7.	The Chatbot can improve efficiency, productivity, and customer service in educational institutions.	Future research can also explore the effectiveness of Chatbots in addressing complex queries and providing personalized information

Table 1. (continued)

Author(s)	Research aim	Research design	Findings	Implications	Research gap
Pavitha et al. (2022)	Developing a Chatbot using nltk library in Python to process data and give precise responses to users.	Descriptive study	The proposed Chatbot has an accuracy of 93% and can be employed in any field.	Presents an economical alternative that demands minimal initial investment in the developmental phase.	There is a lack of literature concerning the accuracy level of Chatbots in libraries
Praveen Gujjar and Prasanna Kumar (2022)	Creating a Chatbot system with text reinforcement techniques.	Experimental study	The Chatbot performed text augmentation at character, word and sentence domains to provide accurate results for user queries.	The study highlights the significance of text reinforcement in creating a robust Chatbot system and suggests future work to explore multimedia file augmentation.	The sample size and demographics are not mentioned, and the study does not compare the performance of Chatbots with and without text augmentation.
Rodriguez and Mune (2022)	To detail the development and implementation of an AI Chatbot in a university library	Case study	Creating and deploying a university library Chatbot easily with existing AI tools, but training is important to handle common inquiries.	Libraries utilize Chatbots to address requests for information with no extensive need for technology training or facilities. Following the procedures for Chatbot development on library websites is essential.	Challenges associated with AI Chatbots in libraries were not discussed. The impact of Chatbots on user satisfaction and the risks were not covered.
Rubin et al. (2010)	Investigating developments and applications of conversational agents in Canadian libraries	Survey of the library websites in Canada	Canadian libraries lack AI conversational systems, while other technologies thrive. The library community must discuss their library purposes.	Implementing conversational agents is essential for quality library services	Exploring more on pros and cons of conversational agents in library services.
Sanji et al. (2022)	Featuring Chatbot as a novel AI tool and demonstrating its applicability in various areas of library services.	Theoretical paper	Despite the limited employment of Chatbots in libraries, it is crucial for libraries to utilize the potential of this potent tool to enhance user satisfaction.	Implementing Chatbot in diverse library departments and citing applied instances in selected libraries.	More research is needed to explore the specific ways wherein Chatbots enhance library services and key challenges faced by librarians
Sorna Shanthi et al. (2019)	Building a Chatbot named Hexabot that enhances remote access to university library resources	Conceptual	Integrated with Facebook Messenger, Hexabot enables students to explore the library resources anytime and anywhere.	The proposed Chatbot can improve library services for patrons.	Exploring the role of library resources in relation to Chatbot implementation in various educational and non-educational settings.
Tella and Ajani (2022)	Examining humanoid robots utilization in library systems	Conceptual analysis	Humanoid robots have essential benefits for public library services	Strategic planning is crucial for integrating emerging technologies such as humanoid robots into library systems	Assessing the effectiveness and user acceptance of humanoid robots in libraries, and their impact on job roles is a fruitful research area.

Table 1. (continued)

| Author(s)	Research aim	Research design	Findings	Implications	Research gap
Thalaya and Puritat (2022)	Examining the effectiveness of an AI Chatbot BCNPYLIB Chatbot for answering library questions and enhancing services	Experimental study of nursing students and teachers	BCNPYLIB Chatbot improved library service management and user satisfaction by effectively answering questions.	The use of AI Chatbots for library services in other academic disciplines and institutions needs to be explored further.	Identifying the specific types of library-related questions that can be effectively addressed by AI Chatbots.
Vincze (2017)	Enhancing reference services by incorporating Chatbot applications within libraries	Exploratory paper	Although Chatbots are unable to emulate the intricate nature of interactions, encompassing both cognitive and affective aspects, they can offer a cost-efficient method to resolve most mundane reference queries.	Chatbots possess the potential to simplify the reference department activities by addressing the bulk of ordinary inquiries, thereby enabling the library staff to concentrate on other duties.	Integrating Chatbots into libraries to improve service quality of specific departments
Wollny et al. (2019)	The learner modeling for personalized content delivery in online educational portals (OEPs) using web analytics data	Comparative analysis of data structure	The study identified two major challenges that need to be addressed to accomplish customized content and learning skills on educational portals using learner modeling	The findings of the study suggest the need for further research to address the identified challenges and develop effective methods for implementing learner modeling in OEPs	Investigating the effectiveness of different techniques for implementing learner modeling in OEPs and explore ways to overcome challenges.
Zhang (2023)	To investigate how academic law libraries are presently employing Chat reference and propose ways to address staffing challenges.	Survey research of the websites of law libraries.	Implementing Chatbots can help to expand reference service hours and foster an engaging experience for library websites.	Provides insights and suggestions for academic law libraries to adopt Chat reference and Chatbots to provide reference services remotely.	The study did not explore the impact of Chatbots on user satisfaction or the effectiveness of Chatbots in providing reference services.

Source: Authors' own work.
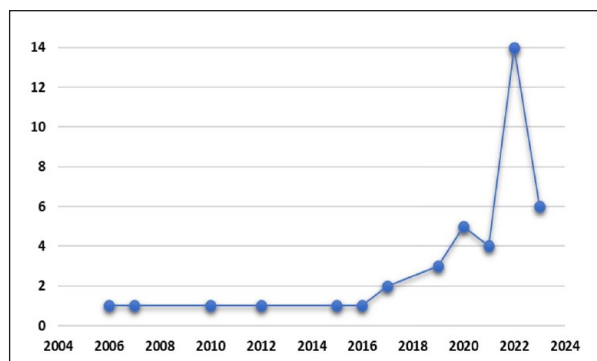
Figure 3. A timeline of research on Chatbots utilization in libraries.
Source: Authors' own work.

early Chatbots needed to be more functional and often struggled to respond accurately to complex queries. Recent advances in "natural language processing" (NLP) and "machine learning" have greatly improved the capabilities of Chatbots, allowing them to comprehend and respond to a broader range of user inquiries. For example, Chatbots can now be integrated with library systems such as the catalog and the circulation system, allowing users to check out and renew books, access accounts and resources, get research support, and receive notifications from the Chatbot.

As Chatbots have evolved, they have become more personalized in terms of their functionality and capabilities, including their ability to process natural language rather than relying on rigid command structures and use machine learning algorithms to learn from library user interactions by analyzing patterns in large datasets to understand and respond better to user requests (Pavitha et al., 2022). For instance, library Chatbots can provide personalized

multilingual support through understanding and responding in multiple languages, making library resources more accessible to non-native speakers.

Another essential aspect of Chatbot's evolution has been its integration with voice assistants and mobile apps. This integration has enabled Chatbots to provide users with more personalized and contextualized assistance and access a broader range of data and services (Griol et al., 2017). For instance, as voice assistant technology improves, Library Chatbots can be incorporated with devices such as Amazon Echo and Google Home, granting users specific access to library resources with voice commands. Integrating library Chatbots' deep learning has enabled them to learn from library user interactions and improve their performance over time. This has allowed library Chatbots to become more adaptable and responsive to changing user needs and preferences (Panda and Chakravarty, 2022).

Theme 2: Antecedents for Chatbot use in libraries

Utilization of Chatbots in libraries can be affected by a range of factors that can be classified into technological, organizational, user-related, and external antecedents. Here are the main antecedents that may affect library Chatbot usage.

Technological antecedents: The library's technological readiness and capacity to support Chatbots have been identified as essential antecedents. The availability of technology infrastructure, the library's technical expertise, and the integration of Chatbots with existing systems and websites are crucial in determining the feasibility and effectiveness of Chatbots (Thalaya and
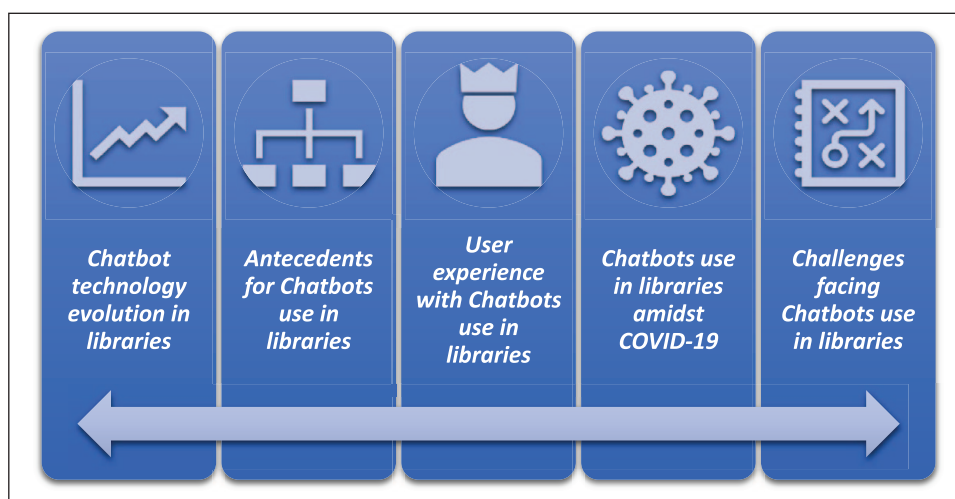

Figure 4. Thematic framework for Chatbot use in libraries.
Source: Authors' own work.

Puritat, 2022). Additionally, the perceived benefits of using Chatbots compared to other technologies, such as email or phone support, have a significant impact.

Organizational antecedents: The adoption of Chatbots in the library is influenced by various factors, such as the library's culture, structure, and strategy. Additionally, the library's budget, the expertise of its staff, and the leadership's willingness to invest in new technologies play pivotal roles in shaping the adoption process (Kaushal and Yadav, 2022). Furthermore, the library's overall mission, goals, and users' needs and preferences impact whether a Chatbot is a viable solution (Cheung et al., 2020). Organizational readiness and support were critical in facilitating library Chatbot adoption.

User-related antecedents: User attitudes and behaviors are crucial in prompting library Chatbot effectiveness (Kaushal and Yadav, 2022). Factors such as user familiarity and comfort with Chatbot technology, perceived usefulness and convenience, trust and privacy concerns, and willingness to engage with Chatbots affect successful implementation (Ali et al., 2020).

External antecedents: The broader social and economic environment influences library Chatbot utilization. For example, the availability and popularity of Chatbot use in other service contexts, as well as the rise of voice-activated assistants, influence library management and user expectations to demand library Chatbots (Aditya et al., 2022; Černý, 2023). Moreover, broader technological trends, such as the increasing use of AI, robots, and machine learning, trigger Chatbot adoption initiatives in the library setting (Rodriguez and Mune, 2022; Rubin et al., 2010).

Theme 3: User experience with Chatbot use in libraries

Several papers have focused on aspects of user experience with library Chatbots (e.g. Cheung et al., 2020; Griol et al., 2017; Hranchak et al., 2022; Jearanaiwongkul et al., 2021; Lin et al., 2021; Loveys et al., 2020; Wollny et al., 2019). With the rising application of Chatbots in libraries, user experience has become a critical factor in their development and deployment as it reflects overall knowledge, practices, and feelings a user has when interacting with a Chatbot (Gomes and Preto, 2018; Yang et al., 2020). The dimensions of user experience with library Chatbot research can be broken down into three key areas: conversational design, usability, accessibility, and effectiveness. Each of these dimensions is critical for ensuring a positive user experience with Chatbots in libraries and understanding these dimensions can help libraries develop effective Chatbots that meet the needs of their users.

Conversational Design: Conversational design is a critical dimension of user experience with Chatbots in libraries. It refers to the structure and flow of the user chatbot dialogue (Mckie and Narayan, 2019). A well-designed conversational flow can help users find the information they need instantly. In contrast, a poorly designed conversational flow can lead to frustration and a negative user experience (Černý, 2023). Libraries need to carefully consider the development of effective conversational strategies that align with user needs and expectations.

Usability: A library Chatbot with a good usability function reflects a simple, intuitive design with clear, concise prompts, and instructions. An aspect of the usability dimension is a user-friendly interface wherein students and staff have easy navigation and a simple way to find the necessary information. For example, if the Chatbot's interface could be more precise or explicit, users may be overwhelmed and unsure how to proceed (Loveys et al., 2020; Mckie and Narayan, 2019). Another aspect is the ability to understand complex queries due to language or cultural barriers and provide irrelevant responses, leading to the frustration of students and staff (Parkar et al., 2021; Sorna Shanthi et al., 2019).

Accessibility: Accessibility is an eminent dimension of user experience with library Chatbots, particularly for disabled users (Cheung et al., 2020). Maintaining adequate Chatbot accessibility requires that the Chatbot interface should be designed with accessibility in mind, including the use of features such as screen readers, keyboard navigation, alternative text descriptions for images, extensive text options, ensuring there is enough contrast between the text and background colors, and use captions for videos (Cheung et al., 2020; Ehrenpreis and DeLooper, 2022; Lin et al., 2021). Libraries must ensure that their Chatbots are accessible to all users to provide an inclusive user experience.

Effectiveness: Effectiveness reflects a Chatbot's ability to meet the user's needs and provide the information or assistance that the user is seeking. A practical library Chatbot provides accurate and relevant information in response to simple and complex queries of students and staff and can handle a wide range of user needs and preferences (Mckie and Narayan, 2019; Panda and Chakravarty, 2022). Moreover, Libraries need to consider effectiveness while maintaining contextual awareness and personalization of their Chatbots when they are linked to various library services such as reference services, information and digital collection, circulation services, interlibrary loans, and outreach services (Nawaz and Saldeen, 2020; Thalaya and Puritat, 2022).

Theme 4: Chatbot use in libraries amidst COVID-19

During the COVID-19 pandemic, libraries faced unprecedented challenges in providing access to information and resources while ensuring staff and users' safety. The pandemic has forced many institutions, including libraries, to adapt to new ways of operation. In response to a greater reliance on virtual services, many libraries have turned to Chatbots to provide virtual assistance and support to their users (Zhang, 2023). Rodriguez and Mune (2022) discussed developing and implementing an AI Chatbot at the San Jose State University library in response to the increased need for virtual services during the COVID-19 pandemic. Google's Dialogflow bot platform developed and trained the Chatbot to address typical information inquiries. The study found that Chatbots can be deployed by libraries with minimum coding experience and tools, although further advancement and examination are necessary to foster users' engagement. Panda and Chakravarty (2022) explored the utilization of an AI Chatbot called "InfoBot" in libraries during the COVID-19 pandemic, suggesting that Chatbots advocate a reliable resolution for libraries to introduce virtual services while implanting a novel module to reference services. They highlighted the potential of AI Chatbots in libraries during the pandemic to overcome time and location barriers and to fall in line with the concept of a "library without walls." Dube and Jacobs (2023) examined the role of academic libraries in providing extended services through the COVID-19 pandemic in Gauteng Province, South Africa. Using a sequential explanatory research design, the study showed that academic libraries maintained vast support to distant users during the pandemic, using various technologies, including Chatbots such as BOTsa, to help users respond to their inquiries promptly. The study also highlights the successful adaptations and improvements to library services to ensure that distant users could acquire the same services and access to resources as before the pandemic.

Theme 5: Challenges facing Chatbot use in libraries

Chatbots are becoming increasingly popular in libraries. However, maintaining a practical library Chatbot is a complex process that requires careful planning and execution. In this respect, extant research has highlighted various types of challenges that hinder the successful use of Chatbots in libraries as follows:

Technical challenges: The technical development of a library Chatbot is a critical dimension of its success. Using the latest technologies and frameworks to ensure the Chatbot system is reliable, secure, and scalable is challenging for any library. This involves working with experienced developers and using agile methodologies to ensure the Chatbot can be developed and tested quickly and efficiently (Sanji et al., 2022). Libraries must also consider the type of Chatbot they want to develop (e.g. text-based, rule-based, or machine learning-based Chatbot) and ensure that it is compatible with the library's existing systems and resources as Chatbots need to work on platforms and devices ranging from a library management system, databases, and other third-party applications to desktop computers, mobile devices, and smart speakers. Compatibility can also be a technical challenge (Ali et al., 2020; Tella and Ajani, 2022). Maintenance and updates are also critical challenges that necessitate close monitoring of the Chatbot's performance, resolving any issues that arise to reflect changes in library systems and resources, and incorporating new features and functionality based on user feedback (Adetayo, 2023).

User feedback and emotional challenges: Not all libraries proactively seek and incorporate user feedback into the development process. This includes conducting user testing and surveys to identify user needs and preferences and using this information to improve the Chatbot's functionality and usability. Libraries can use tools such as sentiment analysis to monitor user feedback and identify areas for improvement. Moreover, library Chatbots appear limited to recognizing and responding appropriately to users' emotions, which can impact the user experience (Adetayo, 2023; Černý, 2023).

Economic challenges: Cost is a significant challenge associated with developing and maintaining the Chatbot. Libraries should have the essential facilities and resources to sustain Chatbots over the long term, including costs associated with hosting, maintenance, and updates and the costs associated with staffing and training (Jearanaiwongkul et al., 2020). Libraries must also consider the long-term sustainability of the Chatbot and whether it will continue to meet the needs of students and staff over time (Cheung et al., 2020; Loveys et al., 2020).

User privacy challenges: Chatbots may collect user data, which can raise concerns about privacy and data security. Libraries have a responsibility to protect the privacy and confidentiality of their user's personal information, including their queries and interactions with Chatbots and how user data is collected, stored, and used (Kaushal and Yadav, 2022; Lund and Wang, 2023). Thus, regular audits of the Chatbot's data storage and usage practices are crucial to ensure they comply with privacy laws and regulations. Libraries can also obtain user consent before collecting personal information, including informing users about what information is being collected, how it will be used, and how long it will be stored.

Discussion

The utilization of Chatbots in libraries has evolved significantly over the past 17 years, thanks to advances in NLP, machine learning, and integration with other technologies such as voice assistants and mobile apps. Library Chatbots are now capable of providing personalized and multilingual support to users. They can be integrated with library systems to check out and renew books, access accounts and resources, get research support, and receive notifications. However, literature on Chatbot use in libraries is still in its embryonic stages, and there is a significant research gap despite its surging curve. Therefore, the findings of this integrative review contribute to the body of knowledge on the nexus between artificial intelligence and library operations. It also furnishes academics and practitioners with potential directions for future research opportunities in this area. The findings of this integrative review emphasized the leading emergent themes in library Chatbot research: (1) The evolution of Chatbots technology in libraries, (2) Antecedents for Chatbot use in libraries, (3) User experience with Chatbot use in libraries, (4) Chatbot use in libraries amidst COVID-19, and (5) Challenges facing Chatbot use in libraries.

The integration of Chatbots in libraries has undergone an evolution in terms of their functionality, capabilities, and integration with other technologies, such as voice assistants and mobile apps. Chatbots' use in libraries is also influenced by various technological, organizational, user-related, and external factors contributing to their successful adoption. Dimensions of users' experience involving conversational design, usability, accessibility, and effectiveness with library Chatbots emerged as a critical theme for effective development and deployment. The literature also discussed the role of Chatbots' integration in libraries during the COVID-19 pandemic, considering their potential benefits for library services and users during emergencies and catastrophes. However, our integrative review has identified several challenges that need to be addressed for library Chatbots' successful implementation and sustainability. These challenges include technical issues related to Chatbot development, compatibility, maintenance, and updates; user feedback and emotional challenges; economic challenges associated with cost, staffing, and long-term sustainability; and user privacy challenges emphasizing data collection, storage, and usage policies and procedures. Libraries must address these challenges and implement appropriate solutions to ensure the effectiveness and sustainability of their Chatbots. For instance, implementing regular training programs for library staff to enhance their familiarity with Chatbot capabilities could ensure better integration and user support.

Additionally, incorporating user feedback mechanisms and actively seeking input through surveys or focus groups can enable libraries to refine chatbot functionalities based on patrons' evolving needs continuously. Furthermore, exploring partnerships with technology experts or engaging in collaborative ventures with other libraries can provide valuable insights and resources to address technical challenges and optimize Chatbot performance. These proactive interventions contribute to a dynamic and responsive Chatbot system within the library ecosystem. Furthermore, libraries must prioritize user privacy and data security while implementing Chatbots and ensure compliance with privacy laws and regulations. In this respect, libraries must employ robust encryption methods for secure data transmission and storage. The implementation of solid user authentication measures, including multifactor authentication, restricts access to authorized personnel only. Embracing a data minimization policy helps mitigate risks by collecting only essential user information. Regular security audits identify and address vulnerabilities, while compliance with privacy laws and transparent communication of privacy policies build user trust. Keeping software and systems updated with the latest security patches is crucial, and ongoing staff training ensures awareness of security risks and best practices.

Implications for future research avenues

This integrative review highlights the need for future research that can provide a deeper understanding of the challenges and opportunities associated with Chatbot use in libraries. By addressing these under-researched areas, researchers can provide valuable insights for future development and implementation of Chatbot use in libraries.

First, one of the critical areas for further examination is ethical concerns about Chatbot use in libraries. Adopting Chatbots in libraries raises several ethical concerns, including potential bias and discrimination caused by Chatbots use in libraries. Moreover, the transparency of Chatbots means that users should be given the option to interact with a human if they prefer, and libraries must be transparent about the use of Chatbots. They should disclose to users that they are interacting with a Chatbot.

Second, policy guidelines must ensure that libraries using Chatbots comply with best practices. Future research can develop policies addressing policy issues such as data privacy and security, transparency, user consent, data encryption, data that Chatbots will collect, how that data will be used, and how it will be protected. Another potential research area is investigating the relationship between Chatbot policies and procedures and library employee behavior. This could involve examining the extent to which policies and procedures influence behavior and how library culture and leadership may impact the effectiveness of such policies.

Third, another critical area for future research is conducting more comparative studies to determine the most effective types of Chatbots for different library settings and user needs. While there has been limited research comparing the effectiveness of different types of Chatbots in library settings, there is still much to be explored in terms of the types of Chatbots that work best for specific library contexts and user groups with unique needs and preferences. For instance, a Chatbot designed for young adult users may have a different interface and approach than one designed for faculty members or senior staff.

Fourth, there is a need for more research on the information-seeking behavior of library users and how Chatbots can be used to support their needs. For example, scholars can explore the types of questions and queries that students and staff typically ask and how Chatbots can be programmed to respond to them. This research can also investigate the effectiveness of different types of Chatbots in addressing different types of information needs and the potential impact on user experience. It would also be beneficial to explore research on using Chatbots in various contexts, particularly in corporate customer service, where Chatbots have advanced significantly (Ngai et al., 2021). Sometimes, a Chatbot may reach a point where human intervention is necessary for more complex interactions (Grimes et al., 2021; Knott, 2023). It is also vital for determining the appropriate situations in which a Chatbot should transfer a conversation to a human agent. This decision should be carefully considered and integrated into the overall design of the Chatbot system. Understanding how this handoff is managed and under what circumstances it occurs is crucial for optimizing the user experience (Adam et al., 2021).

Fifth, most research overlooked the role of library culture and structure in successfully adopting and using Chatbots. Culture and structure can influence the level of support for new technology adoption, the allocation of resources, and the attitudes of library staff and users toward Chatbots. Therefore, understanding how the culture and structure of a library affect the development, implementation, and maintenance of Chatbots is a fruitful avenue for forthcoming research. For example, libraries with a strong culture of innovation and a willingness to experiment with new technology may be more successful in integrating Chatbots into their services and maximizing their benefits. Furthermore, libraries with a flatter organizational structure, with more collaboration and communication between departments and staff, may be better positioned to develop and implement Chatbots that meet users' requirements.

On the other hand, libraries with more rigid hierarchies and siloed departments may encounter more challenges in developing and implementing Chatbots. Staff resistance to change, lack of funding or support from upper management, and difficulties in integrating Chatbots with existing library systems may also arise. These hypotheses necessitate further elaboration in future research.

Six, the scalability issue is a promising future research avenue wherein strategies and solutions to address the scale of Chatbot usage in libraries require further attention. As the number of users and queries increases, Chatbots should be able to handle them without slowing down or crashing. Therefore, future research should focus on developing methods and tools to augment the performance and scalability of library Chatbots handling complex queries and providing personalized recommendations based on user preferences and behavior. Furthermore, voicebots can add an extra layer of scalability, which is particularly significant for inclusive interaction. Voicebots enable users to interact with technology using spoken language, making it more inclusive for individuals with visual or motor impairments (Bérubé et al., 2021). This can enhance the overall accessibility of library services, as it allows for hands-free operation, benefiting users who may have difficulty using traditional input methods. Voicebot systems can be designed to accommodate various speech patterns, catering to a diverse range of users and ensuring that the technology is accessible to a broader audience (Zierau et al., 2023). Exploring these research avenues, scholars can contribute to developing practical, user-friendly, and ethically sound Voicebot applications in library settings to enhance scalability and accessibility.

Limitations

While the purpose of this integrative review was to analyze extant literature on library Chatbots comprehensively, it is essential to acknowledge certain limitations when interpreting the findings. Firstly, the study only utilized the Scopus database as its primary source of literature due to its reliability and broad coverage. However, other databases and sources may have relevant research that should have been included in this study. Future research could explore these additional sources to further contribute to understanding library Chatbots development and deployment. Secondly, the selection of literature for this review was limited to specific entries and keywords despite efforts to ensure the inclusion of all relevant papers. This may have resulted in the omission of some necessary research. Thirdly, papers published or accepted prior to the analysis stage of this study were included in the review. Therefore, caution should be exercised when interpreting the results of recent publications.

Conclusion

Chatbots are increasingly replacing some of the traditional library services provided by humans, and their role in libraries is expanding rapidly with the evolution of artificial intelligence. This paper presents an integrative literature review that examines existing research on Chatbot use in libraries. The review analyzes 40 articles and

conference papers from the Scopus database to identify themes in the literature. The emergent themes include (1) the evolution of Chatbot technology in libraries, (2) antecedents for Chatbot use in libraries, (3) user experience with library Chatbots, (4) Chatbots in libraries during the COVID-19 pandemic, and (5) challenges facing Chatbot use in libraries. Despite the growing interest in researching Chatbots in library services, there still needs to be a significant research gap. The findings of this review donate to the understanding of the intersection between artificial intelligence and library operations and provide six research directions that provide valuable insights for future development and implementation of Chatbot use in libraries.

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