REVIEW

Generative Chatbots in the Era of Library 5.0: A Dilemma for Libraries?

Chatbots Generativos en la Era de la Biblioteca 5.0: ¿Un Dilema para las Bibliotecas?

Vivien Oluchi Emmanuel[1] ⓘ, Mabel Peter Ameh[2] ⓘ, Bolaji David Oladokun[3] ⓘ ✉

[1]Rivers State University, Department of Library and Information Science, Port Harcourt, Nigeria.
[2]Global Banking School, United Kingdom, Birmingham.
[3]Federal University of Technology, Department of Library and Information Technology, Ikot Abasi, Akwa Ibom, Nigeria.

ABSTRACT

Introduction: the advent of Library 5.0 integrates advanced technologies such as artificial intelligence (AI), blockchain, and augmented reality to create inclusive and user-centric experiences.
Objective: this study explored the role of generative chatbots, powered by AI, in transforming library operations within this framework.
Method: this study employed a narrative review to examine the role of generative chatbots in rendering library services in the disruptive era.
Results: findings revealed that generative chatbots offer personalized, accessible, and efficient services by automating routine tasks, providing resource recommendations, and enhancing user engagement. Their integration aligns with the principles of Library 5.0, which emphasize sustainability, inclusivity, and innovation. However, the adoption of generative chatbots poses challenges, including concerns about data privacy, security, and the risk of over-reliance on automation.
Conclusion: this paper indicated strategies for integrating generative chatbots effectively, such as robust data protection measures, staff training, and the establishment of ethical practices. It proposed for a balanced approach that leverages chatbots' strengths while preserving libraries' relational and transformative aspects. The findings further indicated the importance of aligning innovation with traditional library values to ensure the continued relevance and accessibility of library services in the digital age.

Keywords: Library 5.0; Generative Chatbots; Artificial Intelligence; Library Services; Data Privacy.

RESUMEN

Introducción: la llegada de la Biblioteca 5.0 integra tecnologías avanzadas como inteligencia artificial (IA), blockchain y realidad aumentada para crear experiencias inclusivas y centradas en el usuario.
Objetivo: este estudio exploró el papel de los chatbots generativos, impulsados por IA, en la transformación de las operaciones bibliotecarias dentro de este marco.
Método: se empleó una revisión narrativa para examinar el papel de los chatbots generativos en la prestación de servicios bibliotecarios en la era disruptiva.
Resultados: los hallazgos revelaron que los chatbots generativos ofrecen servicios personalizados, accesibles y eficientes al automatizar tareas rutinarias, proporcionar recomendaciones de recursos y mejorar la interacción con los usuarios. Su integración se alinea con los principios de la Biblioteca 5.0, que enfatizan la sostenibilidad, la inclusión y la innovación. Sin embargo, la adopción de chatbots generativos plantea desafíos, como preocupaciones sobre la privacidad de los datos, la seguridad y el riesgo de una dependencia excesiva de la automatización.

Conclusión: este artículo indicó estrategias para integrar eficazmente los chatbots generativos, tales como medidas robustas de protección de datos, capacitación del personal y el establecimiento de prácticas éticas. Propuso un enfoque equilibrado que aproveche las fortalezas de los chatbots mientras se preservan los aspectos relacionales y transformadores de las bibliotecas. Los hallazgos también subrayaron la importancia de alinear la innovación con los valores tradicionales de las bibliotecas para garantizar la relevancia y accesibilidad continua de los servicios bibliotecarios en la era digital.

Palabras clave: Biblioteca 5.0; Chatbots Generativos; Inteligencia Artificial; Servicios Bibliotecarios; Privacidad de Datos.

INTRODUCTION

The evolution of libraries is characterized by adoption of emerging technologies to enhance information access and service delivery. The concept of Library 5.0 represents the next phase in this progression, emphasizing the integration of advanced technologies like artificial intelligence (AI), blockchain, augmented reality (AR), and the Internet of Things (IoT) to create hyper-personalized, immersive, and user-centric library experiences.[1] Unlike its predecessors, Library 5.0 is not solely focused on digital transformation but also aims to harmonize technological advancements with human needs, fostering inclusivity, sustainability, and meaningful engagement.[2] This paradigm shift aligns with the broader societal transition to the Fifth Industrial Revolution (5IR), characterized by blending human creativity and emotional intelligence with cutting-edge technologies. For libraries, this evolution signifies reimagining their roles from mere custodians of information to dynamic spaces that anticipate and adapt to the complex and evolving needs of diverse user groups.

Amid this transformation, generative chatbots have emerged as a groundbreaking application of AI, capable of producing human-like responses, generating creative content, and facilitating complex interactions.[3] Powered by advanced models like OpenAI's GPT-4, these chatbots have the potential to revolutionize library services by enhancing information retrieval, automating administrative tasks, and providing 24/7 virtual assistance. [4] Their ability to simulate human conversation and generate nuanced responses has positioned them as valuable tools in addressing the increasing demand for personalized and efficient library services. However, the integration of generative chatbots into library operations is not without challenges.

This paper explores the implications of integrating generative chatbots within the Library 5.0 framework, highlighting both their potential to enhance service delivery and the dilemmas they pose for libraries navigating this paradigm shift. The central thesis argues that while generative chatbots offer innovative solutions for reimagining library services, their integration must be carefully managed to align with the core values of libraries—equity, reliability, and trustworthiness. Further, the study aims to provide insights into how libraries can harness the potential of generative chatbots while safeguarding their institutional integrity and relevance in the era of Library 5.0.

DEVELOPMENT

Understanding Generative Chatbots

Generative chatbots are advanced conversational agents powered by artificial intelligence (AI) models, designed to produce human-like responses and generate content based on the input they receive. Unlike rule-based chatbots that operate on pre-programmed scripts and limited datasets, generative chatbots utilize machine learning algorithms, particularly natural language processing (NLP) and large language models (LLMs), to understand and respond to user queries in a dynamic and contextual manner.[5] Pap and Oniga[6] mention that chatbots, such as OpenAI's ChatGPT, Google's Bard, and Microsoft's Bing AI, are capable of engaging in multifaceted conversations, generating creative outputs, and even learning from interactions over time. Their functionality is rooted in their ability to analyze massive datasets, discern patterns, and produce outputs that mimic human language, making them versatile tools for a wide range of applications. Through their adaptive capabilities, generative chatbots have redefined the boundaries of automated communication, enabling more intuitive and meaningful interactions between users and machines.

The use of generative chatbots has rapidly expanded across various industries, showcasing their adaptability and potential.[7] In the healthcare sector, chatbots like Ada and Babylon provide medical advice, symptom checking, and appointment scheduling, enhancing patient engagement and streamlining healthcare delivery.[8] In the education field, platforms such as Duolingo leverage generative AI to offer personalized language learning experiences, while educational institutions use chatbots to provide academic advising and answer student queries.[9] Similarly, in the financial sector, chatbots like Erica by Bank of America and Cleo offer budget tracking, financial advice, and customer support.[10] These examples underscore the widespread adoption of generative chatbots as tools that bridge the gap between technological efficiency and user-centric service

delivery.

In the context of libraries, the potential benefits of generative chatbots are vast, particularly in enhancing access to information and improving the efficiency of library services. [11, 12, 13] Oladokun et al.[12] state that chatbots provide users with access to assistance at any time, addressing queries related to catalog searches, resource recommendations, and research guidance. Additionally, generative chatbots can play a pivotal role in promoting digital literacy by guiding users through complex platforms, databases, and tools, thereby reducing barriers to information access.[14] Furthermore, the integration of generative chatbots can free up human librarians to focus on more complex tasks that require critical thinking and human judgment, such as research consultations and community outreach initiatives.[15]

Library 5.0: Evolution of Library Services

Library 5.0 represents the latest phase in the evolution of library services, a paradigm that harmonizes cutting-edge technologies with human values to create user-centric, inclusive, and immersive experiences.[2] Building upon the foundations laid by its predecessors—Library 1.0 (print-based services), Library 2.0 (interactive Web 2.0 technologies), Library 3.0 (digital and virtual resources), and Library 4.0 (smart technologies and automation)—Library 5.0 is rooted in the principles of the Fifth Industrial Revolution (5IR).[16] This phase shifts the focus from technology-driven operations to a more holistic approach that integrates emotional intelligence, sustainability, and user empowerment. It reimagines libraries not only as repositories of knowledge but also as dynamic, collaborative spaces that prioritize meaningful human engagement, inclusivity, and community-driven innovation. At its core, Library 5.0 is a framework designed to blend technological advancements with human creativity and needs, ensuring that libraries remain relevant in an increasingly complex and interconnected world. [17]

The distinguishing features and advancements of Library 5.0 highlight its transformative potential and its alignment with emerging technologies. According to Panda et al.[18], one of its defining characteristics is the integration of immersive technologies such as augmented reality (AR) and virtual reality (VR) to provide enriched and interactive learning experiences. Libraries adopting Library 5.0 can offer virtual tours, gamified educational content, and simulations that engage users in ways that were previously unimaginable.[19] Additionally, Tella et al.[20] note that blockchain technology plays a pivotal role in ensuring data integrity and transparency, enhancing the security of library records, and streamlining digital rights management. The Internet of Things (IoT) further enhances library operations by enabling smart infrastructure that optimizes resource utilization, environmental conditions, and user comfort.[21] Oyetola et al.[22] maintain that artificial intelligence (AI) remains a cornerstone of Library 5.0, driving tools like recommender systems, predictive analytics, and generative chatbots to deliver personalized and efficient services. These advancements collectively redefine the library as a space that merges the physical and digital realms, fostering accessibility, collaboration, and innovation.

The alignment of Library 5.0 with technological innovations, particularly generative chatbots, underscores its commitment to transforming the library experience. Wagwu et al.[13] note that generative chatbots, powered by advanced AI models, exemplify the principles of Library 5.0 by providing hyper-personalized interactions and bridging gaps in accessibility and inclusivity. These chatbots are capable of responding to complex user queries, offering tailored recommendations, and assisting with tasks such as resource discovery, research guidance, and account management.[12] They also reduce the workload on human staff, allowing librarians to focus on strategic and community-oriented roles while maintaining high levels of service quality. Moreover, generative chatbots contribute to the sustainability goals of Library 5.0 by optimizing resource utilization and minimizing inefficiencies in service delivery. Through the integration of such advanced technologies, Library 5.0 not only modernizes the operational frameworks of libraries but also reinforces their role as inclusive, adaptable, and future-ready institutions.

Implications of Integrating Generative Chatbots in Libraries

The integration of generative chatbots into libraries carries profound implications, reshaping how library services are delivered and experienced.[11] According to Oladokun et al.[12], one of the most significant benefits is the enhancement of user experience and accessibility. Generative chatbots provide immediate, personalized, and round-the-clock support, ensuring that users can access library services and resources without time or location constraints. These AI-powered tools are particularly beneficial for users who may face barriers to traditional library access, such as individuals with disabilities, those in remote locations, or users unfamiliar with complex library systems. This seamless interaction fosters a sense of empowerment and engagement, as users receive tailored assistance, discover relevant resources, and navigate library platforms with ease. The enhanced accessibility brought about by generative chatbots ensures that libraries uphold their mission to provide equitable access to information in an increasingly digital world.

Generative chatbots also significantly improve operational efficiency by handling routine inquiries and tasks, freeing up human staff to focus on more complex and value-added responsibilities.[23] These chatbots excel

at managing high volumes of user queries simultaneously, reducing wait times and streamlining interactions. Tasks such as answering frequently asked questions, assisting with catalog searches, and providing instructions for accessing digital resources are efficiently managed by chatbots, minimizing the burden on library staff.[24] Moreover, chatbots proactively recommend resources, send notifications about overdue items, or guide users through research processes, enhancing service delivery. This efficiency not only optimizes resource utilization but also enables libraries to meet the demands of a growing and increasingly tech-savvy user base. In so doing, generative chatbots contribute to a more productive and user-focused library environment, allowing librarians to dedicate their expertise to activities such as community outreach, research support, and program development.[12]

However, the integration of generative chatbots in libraries also raises important challenges and concerns, particularly regarding privacy, data security, and job displacement.[25] Ocks and Salubi[26] note that privacy is a critical issue, as chatbots often require access to user data to provide personalized services. This raises concerns about how user information is collected, stored, and used, especially in the context of sensitive or confidential queries. Libraries implement robust data protection measures to ensure compliance with privacy regulations and to maintain user trust. Similarly, data security becomes a pressing concern as cyber threats grow more sophisticated. The integration of chatbots necessitates safeguarding systems against potential breaches and ensuring that library databases remain secure.[27] Additionally, the adoption of generative chatbots may spark fears of job displacement among library staff.[13] While chatbots are intended to augment rather than replace human roles, there is a risk that their efficiency could lead to the undervaluation of human expertise.

The integration of generative chatbots in libraries thus represents a double-edged sword: while they offer transformative benefits in enhancing user experience and operational efficiency, they also necessitate careful consideration of ethical, technical, and workforce implications. Striking a balance between leveraging these advanced technologies and preserving the human essence of library services will be crucial as libraries navigate the evolving landscape of the digital age.

Should Libraries Grapple with Generative Chatbots?

The question of whether libraries should adopt generative chatbots has sparked a debate that juxtaposes the potential benefits of technological innovation against the core values and traditions of library services. Proponents of adopting generative chatbots argue that these tools are indispensable for modernizing libraries and meeting the evolving needs of their users.[28] Generative chatbots, powered by advanced AI, can provide immediate, personalized, and scalable support to a wide range of patrons, offering a level of accessibility and convenience that human staff alone cannot consistently achieve.[12] They are particularly effective in handling repetitive and routine inquiries, such as guiding users to library resources, assisting with account management, and answering frequently asked questions. Furthermore, chatbots enhance user engagement by offering tailored recommendations and learning pathways, fostering a dynamic and interactive library experience.[11] For libraries operating under budgetary constraints, chatbots can offer cost-effective solutions to maintain high service standards without overburdening existing staff. In this context, generative chatbots are seen as tools that extend the reach and relevance of libraries in an increasingly digital and fast-paced world.

On the other hand, Kaushal and Yadav[29] observe that critics of integrating chatbots into library services raise concerns about the potential risks and unintended consequences of such advancements. Oladokun et al.[12] maintain that one of the primary arguments against chatbots is the threat they pose to the personal, human-centered ethos that has long defined libraries. Libraries are traditionally viewed as spaces of connection, where patrons engage with knowledgeable professionals who provide not only information but also empathy, guidance, and a sense of community. Relying too heavily on generative chatbots could erode this relational aspect, reducing libraries to transactional platforms rather than transformative spaces. Critics also highlight the ethical and technical challenges associated with chatbot use, including issues of privacy, data security, and algorithmic biases.[11] Hasal et al.[30] note that users may be wary of sharing sensitive information with chatbots, particularly if the library cannot guarantee the confidentiality and integrity of its data systems. Additionally, there is a risk that chatbots, despite their sophistication, might produce inaccurate, incomplete, or biased responses, potentially undermining the quality of service. The fear of job displacement is another concern, as the adoption of chatbots might lead to the undervaluation of human expertise, resulting in a diminished role for librarians in the delivery of services.[12]

Integrating generative chatbots does not necessarily mean abandoning the human touch; instead, these tools can be positioned as complementary assets that augment, rather than replace, the contributions of library staff.[31] Wagwu et al.[13] note that chatbots manage routine tasks, freeing up librarians to focus on more complex and interpersonal functions, such as research support, community engagement, and strategic planning. Libraries should also prioritize ethical and transparent use of chatbot technology by implementing robust data protection measures, ensuring algorithmic accountability, and maintaining user trust. Furthermore, libraries can foster a hybrid service model where technology enhances efficiency while librarians continue to

provide the personal expertise and mentorship that patrons value. The decision to adopt generative chatbots is not a binary choice but rather an opportunity for libraries to redefine their services in alignment with the needs of the digital age. By thoughtfully integrating chatbots while upholding their commitment to accessibility, inclusivity, and quality, libraries can navigate the challenges of technological innovation and remain vital to the communities they serve.

Strategies for Integration and Mitigation of Concerns

Integrating generative chatbots into library services requires a carefully planned and strategic approach to ensure their effective deployment while addressing potential challenges.[32] The first step is conducting a comprehensive needs assessment to determine the specific areas where chatbots can add value, such as routine inquiries, catalog navigation, or personalized recommendations. Libraries should collaborate with key stakeholders, including librarians, IT professionals, and patrons, to identify service gaps and design chatbot functionalities that align with the institution's mission and user expectations. Selecting the right chatbot platform is equally critical, as it must be adaptable, scalable, and capable of integration with existing library systems. Libraries should prioritize solutions that allow for customization to reflect their unique services, resources, and branding. Additionally, pilot testing is essential to evaluate the chatbot's performance in real-world scenarios, gather user feedback, and make necessary adjustments before full-scale implementation.

Addressing privacy and security concerns is a paramount consideration in the integration process. Generative chatbots often handle sensitive user information, such as personal data and search histories, making robust data protection measures essential. Libraries must comply with data privacy regulations, such as the General Data Protection Regulation (GDPR) or local equivalents, to safeguard user information. This includes encrypting data transmissions, limiting data retention periods, and ensuring that third-party chatbot providers adhere to strict security standards. Transparency is also key; libraries should clearly communicate their data collection and usage policies to users, fostering trust and accountability. Moreover, implementing user consent mechanisms, such as opt-in features for data sharing, empowers patrons to make informed decisions about their interactions with chatbots. Libraries can further mitigate security risks by regularly auditing chatbot systems for vulnerabilities and updating them to address emerging threats. By prioritizing privacy and security, libraries can build user confidence and protect the integrity of their services.

Ensuring staff training and involvement is another crucial aspect of successful chatbot integration. Librarians and staff play a central role in adopting and operating generative chatbots, and their expertise should be leveraged throughout the process. Training programs should focus on familiarizing staff with the chatbot's functionality, troubleshooting common issues, and understanding its limitations. This ensures that librarians can seamlessly complement the chatbot's capabilities by providing human oversight and support when needed. Staff involvement also extends to the design and refinement of chatbot systems, as their insights into user behavior and library operations are invaluable for tailoring chatbot interactions. Furthermore, libraries should adopt a collaborative approach, framing chatbots as tools that enhance, rather than replace, the roles of librarians. Open communication about the goals and benefits of chatbot integration can alleviate fears of job displacement and foster a sense of ownership among staff.

CONCLUSION

This study explored the integration of generative chatbots within the Library 5.0 paradigm, highlighting their transformative potential alongside notable challenges. Generative chatbots can revolutionize library services by improving user accessibility, operational efficiency, and personalized service delivery. These AI-driven tools address routine inquiries, offer tailored recommendations, and bridge accessibility gaps, especially for underserved or remote users. Within the inclusive and innovative framework of Library 5.0, chatbots contribute to reimagining libraries as dynamic knowledge hubs.

However, concerns surrounding privacy, data security, and ethical implications of automation remain critical. The reliance on user data for personalized services raises questions about confidentiality and system vulnerabilities, necessitating robust data protection. Additionally, while chatbots enhance efficiency, their thoughtful implementation is essential to preserve the human-centered ethos of libraries and maintain the roles of librarians. Balancing technological advancement with traditional library values of equity, trust, and community engagement is imperative. Ultimately, the integration of generative chatbots offers promising opportunities for libraries but requires strategic approaches, including stakeholder collaboration, ethical practices, and staff training. These measures ensure that libraries harness the potential of generative chatbots while safeguarding their integrity and relevance. This study calls on libraries to adopt innovation cautiously, ensuring that technological advancements align with their mission to provide equitable, accessible, and meaningful services to all.

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AUTHORSHIP CONTRIBUTION
Conceptualization: Vivien Oluchi Emmanuel, Mabel Peter Ameh, Bolaji David Oladokun.

Data curation: Vivien Oluchi Emmanuel, Mabel Peter Ameh, Bolaji David Oladokun.
Formal analysis: Vivien Oluchi Emmanuel, Mabel Peter Ameh, Bolaji David Oladokun.
Research: Vivien Oluchi Emmanuel, Mabel Peter Ameh, Bolaji David Oladokun.
Methodology: Vivien Oluchi Emmanuel, Mabel Peter Ameh, Bolaji David Oladokun.
Supervision: Vivien Oluchi Emmanuel, Mabel Peter Ameh, Bolaji David Oladokun.
Drafting - original draft: Vivien Oluchi Emmanuel, Mabel Peter Ameh, Bolaji David Oladokun.
Writing - proofreading and editing: Vivien Oluchi Emmanuel, Mabel Peter Ameh, Bolaji David Oladokun.