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AI-Driven Chatbots for Library Services towards Transforming Patrons' Engagement in Nigerian University Libraries

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Abstract
The study investigated the use of AI-driven chatbots for library services in transforming patrons' engagement in Nigerian University Libraries. Descriptive survey research was used. The study population comprised 39 professional librarians from selected public universities in the South-south zone of Nigeria. A questionnaire served as the primary data collection tool. Out of 39 distributed questionnaires, 37 usable responses were retrieved and analysed using descriptive statistics. The results revealed a generally positive perception of chatbot services among librarians, indicating potential enhancements in user experience, improved accessibility, and streamlined library queries. Similarly, AI-driven chatbots were seen as beneficial tools for handling routine inquiries, offering continuous support, and enhancing scalability. Challenges identified included infrastructure issues, resistance from librarians, lack of skilled personnel, and insufficient awareness about the benefits of AI-driven chatbots. Based on these findings, the study recommended that university libraries should organise training programs for staff in order to optimize AI functionality for library services.

Keywords: AI-driven chatbots, Library Services, Patron Engagement, Artificial Intelligence, User Interaction, Information Access

INTRODUCTION

Libraries have long been essential for facilitating information access, advancing research, and advancing education. Since the emergence of digital technology, libraries have added digital collections, online resources, and support services to their list of offerings in addition to physical resources. However, due to a lack of funding, the need for round-the-clock support, and the deluge of digital information, libraries struggle to satisfy the varied and changing demands of their users. Chatbots powered by artificial intelligence (AI) provide a viable way to improve library services in the digital era. A computer software that mimics a human communication with a user is called a chatbot (IBM, 2023). While not all chatbots have artificial intelligence (AI) built-in, contemporary chatbots increasingly make use of conversational AI strategies such as natural language processing (NLP) to comprehend user inquiries and provide automated replies. Russell and Norvig (2022) claim that chatbots employ natural language processing and AI algorithms to communicate with users, comprehend their inquiries, and provide relevant information and support.

There are several advantages to using AI-driven chatbots in library services. Adetayo (2023) states that AI-driven chatbots have improved the efficiency of handling routine inquiries in the library. Oladokun et al. (2023) add that chatbots assist in providing 24/7 support to library users, enhancing accessibility to information. AI-driven chatbots have helped in freeing up staff time to focus on more complex patron queries or tasks. (Oyelude, 2023). First of all, Wagwu et al. (2024) state that users may always get help and information from chatbots as they are available around the clock. For students and researchers who may have inquiries or want assistance outside of usual library hours, AI-driven chatbots offer such services (Oladokun et al., 2024). Furthermore, Owolabi et al. (2022) mention that chatbots can manage many inquiries at once, cutting down on wait times during busy times. They may also pick up on feedback from users and keep refining their replies to become more precise and effective over time. Furthermore, by assisting with searches, supplying citations, and making tailored suggestions, AI-driven chatbots may help users navigate digital resources (Zhang, 2023). This tailored strategy improves the user experience and entices users to browse the digital assets of the library. But when integrating AI-powered chatbots into library services, it's important to take accessibility and diversity into account for all users. Libraries need to guarantee that chatbot interfaces are easily navigable and inclusive of people with diverse technical skills and limitations.

The purpose of this research is to investigate the use and effects of AI-powered chatbots in library services. This study aims to provide light on how libraries might best use this technology to improve patron care and engagement. The results will help libraries make decisions on the integration and enhancement of AI-powered chatbots, which will enhance the digital age library experience for users in general. Therefore, to change patron engagement and assistance at universities in Nigeria, the research investigated AI-driven chatbots in library services.

Statement of the Problem

Nigerian university libraries struggle to successfully engage and serve their users because of a shortage of staff, irregular service hours, delayed responses, a variety of information demands, and the need for efficiency and cost-effectiveness. Integrating AI-driven chatbots into library

services may provide a way to overcome these issues. Chatbots powered by artificial intelligence (AI) may give 24/7 support, and tailored to help users navigate resources, and provide immediate answers to questions. University libraries in Nigeria may use modern technology to improve information access, increase patron involvement, and lighten the burden of library personnel. Given these, the study sought to investigate AI-driven chatbots for library services towards transforming patrons' engagement in Nigerian university libraries.

Objectives of the Study

The specific objectives were:
1. To examine librarians' perceptions of chatbot library services
2. To investigate the benefits of implementing AI-driven chatbots in library services
3. To identify the challenges of implementing AI-driven chatbots in library services

Research Questions

The following research questions guided the study:
1. What are librarians' perceptions of chatbot library services?
2. What are the benefits of implementing AI-driven chatbots in library services?
3. What are the challenges of implementing AI-driven chatbots in library services?

REVIEW OF LITERATURE

The advent of AI-driven technologies has introduced innovative solutions to various fields, including libraries. One such innovation is the implementation of chatbots, AI-powered virtual assistants designed to interact with users, answer queries, and provide information (Bakare et al., 2023). Oladokun et al. (2023) reveal that many librarians perceive chatbots as valuable tools for improving user experience. Chatbots provide instant responses to user queries, reducing wait times and increasing the accessibility of information (Adetayo, 2023). According to Hicks et al. (2020), one of the most appreciated features of chatbot services is their ability to operate 24/7. Westfall (2023) reveals that chatbots significantly improve operational efficiency by automating routine tasks such as answering frequently asked questions, guiding users to resources, and assisting with basic troubleshooting. A primary concern among librarians is the accuracy and reliability of chatbot responses (Oyelude, 2023). Panda (2023) states that there is apprehension about the chatbot's ability to provide correct and relevant information, particularly for more complex or nuanced queries.

The integration of Artificial Intelligence (AI) into various sectors has revolutionized the way services are delivered and consumed. Libraries have increasingly turned to AI-driven chatbots to enhance their service delivery. These chatbots, designed to simulate human conversation and provide real-time assistance, offer numerous benefits to both library users and staff (Oladokun et al., 2023; Okey et al., 2023). AI-driven chatbots provide instant responses to user inquiries, significantly reducing wait times and enhancing user satisfaction. Unlike human staff, chatbots are available 24/7, ensuring that users can access information and assistance at any time of the day or night (Oyelude, 2023). Adetayo (2023) observes that Chatbots offer personalized assistance by using data analytics to understand user preferences and behavior. Chatbots tailor their responses

to individual users, providing more relevant and specific information. According to Bakare et al. (2023), one of the primary benefits of AI-driven chatbots is their ability to automate routine tasks, such as answering frequently asked questions, assisting with catalog searches, and providing information about library services and policies. Also, Aljanabi et al. (2023) state that chatbots help streamline resource management by providing timely information about resource availability and usage patterns. Chatbots collect valuable data on user interactions and queries, providing insights into user needs and behavior (Funmilola, 2019).

AI-driven chatbots are increasingly being adopted in various sectors, including libraries, due to their potential to enhance user experience and streamline operations. Despite their numerous benefits, the implementation of chatbots in library services is not without challenges. Thunstorm (2022) discovers that the effectiveness of AI-driven chatbots largely depends on the quality of data they are trained on. Libraries often have vast and diverse collections of data, which can vary significantly in format and quality (Panda & Kaur, 2023). Integrating AI chatbots with existing library systems, such as catalog databases, user management systems, and digital resources, presents a significant technical challenge. AI-driven chatbots in libraries process a considerable amount of user data, including personal information and interaction histories. Panda and Chakravarty (2022) state that AI algorithms inadvertently perpetuate biases present in their training data. In a library context, this can result in biased responses or recommendations that disadvantage certain user groups. Oyelude (2023) reveals that the complexity of AI algorithms makes it difficult to understand how chatbots arrive at specific decisions or responses. This lack of transparency leads to mistrust among users and staff (Wagwu et al., 2024). Also, Okey et al. (2023) reveal that implementing AI-driven chatbots involves significant initial costs for development, integration, and training. The successful deployment and management of AI chatbots require staff with specialized technical skills (Lateef & Mairaj, 2023).

Oyekale and Zubairu (2023) investigated artificial intelligence awareness, perceptions, and acceptance among university libraries in Osun State, Nigeria. Using a descriptive survey method, they examined ten university libraries in the region. Findings revealed that 80% of respondents were familiar with artificial intelligence (AI), and an equal percentage held a positive opinion of AI, believing it would enhance rather than replace librarian roles. Additionally, all respondents stated that AI had not been implemented in the surveyed libraries. Also, Subaveerapandiyan (2023) explored the use of artificial intelligence (AI) in libraries and its impact on library operations evaluation. The research involved analyzing 66 relevant articles sourced from the Scopus database. After filtering and removing duplicates, 65 articles were evaluated. Results highlighted how AI enhances information retrieval, streamlines workflows, customizes user experiences and introduces novel services in libraries. Ethical considerations, privacy issues, and fair access to materials were identified as crucial factors when integrating AI into library operations.

In another study, Huang et al. (2023) investigated the use of AI in academic library strategy, and compared experiences between China's mainland and the United Kingdom. The study analyzed strategy documents from top-ranked institutions in both regions. Findings indicated that while some academic libraries had adopted AI-based applications, the majority did not emphasize technology in their strategic plans. This study provides one of the first cross-border comparisons of AI use in university libraries, shedding light on the current state of AI adoption and strategic planning in the field. Similarly, Mukherjee and Patra (2023) investigated the utilization of chatbots

in library services. Findings revealed the increasing popularity of chatbots and their applications in various library domains. While not a new development, recent advancements in pattern-matching algorithms and Artificial Intelligence Markup Language (AIML) have contributed to their rise. Chatbots offer promise in supporting librarians' roles across different library tasks, although they are not expected to replace human staff entirely. Also, Yan et al. (2023) aimed to determine the research goals and outcomes related to chatbots in libraries. Findings emphasized technological evaluations, focusing on chatbot design, assessment, features, deployment, and maintenance. Guided and text-based chatbots were predominant, with closed-source solutions commonly integrated into library websites or social media platforms.

From the review, it is observed that several studies have been conducted on artificial intelligence in libraries, and a good number of the research was conducted in Nigerian libraries. However, none of the studies have investigated the integration of AI-driven chatbots for facilitating users' engagement in academic libraries in Nigeria, hence this present study bridged the gap.

METHODOLOGY

The research approach used for this investigation was a descriptive survey. The population of the study comprised 39 library staff of selected public universities in South-south, Nigeria. This further comprised academic librarians at the Federal University, Otueke, Bayelsa (13); Ignatius Ajuru University of Education, Port Harcourt, Rivers State (7); Federal University of Technology Ikot Abasi, Akwa Ibom (5); and University of Port Harcourt, Rivers State (14). As such, a census sampling technique was used for the study, hence the population size was relatively manageable and small. A questionnaire was used as the data collection instrument. The researchers administered the copies of questionnaires personally to the respondents in Akwa Ibom and Rivers States, while one (1) research assistant was engaged to administer the questionnaires to librarians in the university understudied in Bayelsa. Descriptive statistics (mean scores) were used to analyze the data collected. Mean values below 2.5 were disregarded, while those surpassing 2.50 were considered valid. The collected data underwent analysis employing the Statistical Package for the Social Sciences (SPSS) software, a reputable and widely utilized tool for statistical assessments. Out of 39 copies of questionnaires administered, only 37 representing 94.9% were filled and completed successfully.

RESULTS

The findings of the study are presented in the following tables with explanations.

Table 1: What are librarians' perceptions of chatbot library services?

S/N	Librarians' Perceptions	SA	A	D	SD	N	x̄	Remark
1.	I believe that chatbot services enhance user experience in a library setting.	19	12	4	2	37	3.3	Accepted
2.	I think there will be an increase in user engagement due to the presence of chatbot services.	15	11	6	5	37	3.0	Accepted
3.	I think chatbots positively impact library accessibility for patrons seeking information.	9	14	7	8	37	2.6	Accepted
4.	I think the use of chatbot will increase my productivity in other library activities	8	9	15	5	37	2.5	Accepted
5.	I believe chatbot services will streamline the process of answering common library queries.	13	9	8	7	37	2.8	Accepted
	Weighted Mean						2.8	Accepted

Key: SA: Strongly Agree; A: Agree; D: Disagree; SD: Strongly Disagree; = Total; x̄ =Mean.

Librarians' opinions about chatbot library services are shown in Table 1. Overall, the findings point to librarians' generally favorable opinion of chatbot services, indicating that they can improve accessibility, raise user experience, boost engagement, and expedite the process of answering frequent library queries/inquiries.

Table 2: What are the benefits of implementing AI-driven chatbots in library services?

S/N	Benefits of Implementing AI-driven	SA	A	D	SD	N	x̄	Remark
1.	AI-driven chatbots have improved the efficiency of handling routine inquiries in the library.	15	8	7	7	37	2.8	Accepted
2.	Chatbots assist in providing 24/7 support to library users, enhancing accessibility to information.	18	7	9	3	37	3.1	Accepted
3.	AI-driven chatbots have helped in freeing up staff time to focus on more complex patron queries or tasks.	14	13	4	6	37	2.9	Accepted
4.	Chatbots have improved the scalability of library services by handling multiple queries simultaneously.	9	16	5	7	37	2.7	Accepted
5.	Chatbots have contributed to a more personalized user experience in the library.	14	13	5	5	37	3.0	Accepted
	Weighted Mean						2.9	Accepted

Key: SA: Strongly Agree; A: Agree; D: Disagree; SD: Strongly Disagree; = Total; x̄ =Mean.

The benefits of using AI-driven chatbots in library services are shown in Table 2. Data indicates that there are a number of advantages to using AI-driven chatbots in library services. They are regarded as useful instruments for managing standard questions, offering ongoing assistance, releasing employee time, and enhancing scalability.

Table 3: What are the challenges of implementing AI-driven chatbots in library services?

S/N	Challenges	SA	A	D	SD	N	x̄	Remark
1.	Poor electricity supply	14	13	4	6	37	2.9	Accepted
2.	Lack of skilled personnel	9	16	5	7	37	2.7	Accepted
3.	Resistance from librarians	15	11	6	5	37	3.0	Accepted
4.	Poor internet connectivity	9	14	6	8	37	2.6	Accepted
5.	Lack of knowledge about the possible advantages of chatbots powered by artificial in the library	8	9	15	5	37	2.5	Accepted
	Weighted Mean						2.7	Accepted

Key: SA: Strongly Agree; A: Agree; D: Disagree; SD: Strongly Disagree; = Total; x̄ =Mean.

The difficulties in integrating AI-powered chatbots into library services are shown in a table. The majority of the obstacles are related to infrastructure, such as inadequate internet access and electricity supplies, as well as human-centered issues, such as resistance from librarians, a lack of skilled personnel, and a lack of knowledge about the possible advantages of chatbots powered by artificial intelligence.

Discussion of Findings

Findings revealed that librarians have a favorable opinion of chatbot services and believe they can improve accessibility, boost user experience, and expedite answering frequently asked library questions. Overall, librarians' favorable opinions of chatbot services indicate that this technology can improve library services and satisfy changing client demands. It shows a readiness to adopt cutting-edge approaches and use AI-powered technology to improve user experiences and optimize library operations. This result is consistent with that of Oyekale and Zubairu (2023) and Wagwu et al. (2024), who discovered that librarians had a favorable opinion of chatbot AI services.

The results of research question two demonstrated the many advantages of integrating AI-driven chatbots into library services. These advantages include the chatbots' capacity to efficiently handle routine queries, provide round-the-clock assistance, free up staff time, and enhance scalability. Libraries may improve user experiences, maximize their resources, and better serve the changing demands of their customers by using chatbot technology. This result is agreement with the findings of Subaveerapandiyan (2023) and Ogwo et al. (2023), who discovered that AI improves information retrieval, automates processes, customizes user experiences, and provides novel services in libraries.

Lastly, research question three demonstrated that some of the challenges of implementing chatbot library services included human-centric issues like resistance from librarians, a shortage of skilled personnel, and a lack of awareness about the potential benefits of AI-driven chatbots. Infrastructure issues included poor internet connectivity and electricity supply. This validates the findings of Wagwu et al. (2024) and Oladokun et al. (2024). The implications of this finding indicate the need of taking human-centric difficulties and infrastructural constraints into account when integrating chatbots into library services. This is why the collaboration between IT departments, stakeholders, and library personnel is necessary to overcome these challenges.

Conclusion

The study indicated librarians' favorable opinions of chatbot services and showed how they might be used to increase accessibility, optimize user experience, and expedite library inquiries. Similarly, AI-powered chatbots are widely seen as helpful for answering regular questions, offering round-the-clock assistance, and improving scalability, however, the obstacles noted include inadequate staffing, reluctance from librarians, and a lack of knowledge about the advantages of chatbots powered by AI.

Recommendations

The following recommendations were made:

1. University libraries in Nigeria should develop thorough training programs for their employees in addition to taking care of infrastructure problems.
2. University libraries should conduct user feedback studies to customize chatbot services to patron preferences.
3. University libraries should develop and implement ethical guidelines and encourage cooperation between librarians and AI developers for responsible and successful technology integration in library services.

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