



Chapter 1

Application of AI in Academic Library Services: Prospects and Implications for Quality Service Delivery

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ABSTRACT

Academic libraries are mandated to support the information needs of their students, staff, and faculty. In the current technological environment and the influx of artificial intelligence technology into services provision and delivery, this study assessed the knowledge and perception of librarians on the use of AI in library services provision in Ghana. The population for the study consisted of librarians from all 15 public universities in Ghana. Findings from the study revealed that the librarians were knowledgeable of the emergence of AI and sources their information on AI mainly from research articles. It was also revealed that educational level had a significant positive ($r= 0.3, p<0.01$) relationship with the sources of knowledge on AI tools and applications. There was a positive significant relationship ($r= 0.533, p<0.01$) between educational level and the frequency of knowledge acquisition on the application of AI in academic library services provision. Academic libraries are encouraged to invest in AI tools and applications to leverage their advantages.

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INTRODUCTION

Information and its role in development is a necessity in every country. Information is a significant factor of production, playing a major role in the industrial revolution with technological developments in all spheres of human endeavours. Growth is a priority for universities as they pioneer the development and advancement of knowledge. Educational institutions invest in technologies and information resources through their libraries to support their teaching, learning, and research functions. These libraries play a significant role in the collection, organization, dissemination, preservation, and retrieval of information in a timely and organized manner.

Academic libraries are mandated to meet the information needs of their parent institutions by providing access to information resources, information, and reference services and implementing and investing in emerging technologies to optimize their service provision for user satisfaction. Technological advancements and the proliferation of artificial intelligence have transformed the academic library fundamentally by providing invaluable resources with increased access to information.

Artificial Intelligence is an essential technology whose machinery is enhanced with the support of state-of-the-art technological innovations and improvements. Artificial intelligence has emerged as a pervasive form of technology in our everyday lives and now forms a part of various activities in the academic world. The term artificial intelligence (AI), according to Kaliraj and Devi (2022), was coined by John McCarthy and is defined as “the science and engineering of making intelligent machines and brilliant software programs.” It is also “the application of computers and utilization of computer-based products and services in the performance of different library operations and functions or the provision of various services and production of output products” (Tsabedze et al., 2022).

The emergence of AI and its implications on academic library activities, services, and products is critical in the present information-dependent society. The degree to which AI is adopted in the library space is likely to be driven by widespread technical developments and so cannot be controlled by librarians. Its advancement becomes a prevailing threat to the need for professional librarians. The intensive burden on librarians to provide high-quality services to library users due to the information explosion in our present society has led to the integration of modern technologies.

This chapter assesses Artificial Intelligence’s prospective use and implications in academic libraries and analyses librarians’ competencies, perceptions, and skills to use AI supported technologies. The objectives of the chapter are to:

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1. Assess the knowledge and perception of librarians in using AI in Academic libraries.
2. Assess the use of AI in service delivery in Academic libraries.
3. Identify the prospects and implications of AI in Academic libraries.

These hypotheses were also tested:

H1: There is a relationship between one's level of education and their source of knowledge of AI.

H2: There is a relationship between the level of one's education and the frequency of their knowledge of AI acquisition.

REVIEW OF LITERATURE

To serve as a standard against which the finding from the study was measured, the literature was reviewed under the following topics:

Introduction to AI

AI (Artificial Intelligence) is an aspect of computer science committed to developing machines and software programs to perform human-centred tasks dependent on human intelligence. AI systems use algorithms and data to learn from experience and make decisions based on that learning. Several attempts have been made to define AI and what it encompasses. One such definition is that UK Research and Innovation (UKRI) defines AI as a "suite of technologies and tools that aim to reproduce or surpass abilities in computational systems that would require intelligence if humans were to perform them, including learning and adapting, sensing, understanding, interacting, reasoning and planning, acting autonomously, or even creating. It enables us to use and make sense of data" (UKRI, 2021: 4).

There are two broad categories of AI. These are Narrow AI and General AI. Narrow AI, also known as weak AI, is designed to perform specific tasks, such as voice recognition, image recognition, or natural language processing. On the other hand, General AI, also known as strong AI or AGI, is designed to perform any intellectual task that humans can perform. The different forms of AI include machine learning, natural language processing, computer vision, robotics, and expert systems. Machine learning allows computers to learn and improve based on their experience without being explicitly programmed. The underlying concept is the use of machines and intelligence, the human attribute distinguishing them from other

creations. Machines are programmed or taught to use similar human intelligence to process work and achieve a reasonable outcome (Kaliraj & Devi, 2022)

Through the different types of AI, a broad range of applications have been designed and implemented in different spheres of society to augment human capabilities. In healthcare, AI is used to augment disease diagnosis and drug development. It is used for fraud detection and risk analysis in finance. It is also used in developing self-driven cars and traffic management (Gasparini & Kautonen, 2022) in the transportation sector and for personalized learning and student performance assessment in education. It is also integrated into knowledge discovery and chatbot applications to offer virtual and remote reference services in academic libraries (Cox, 2022; Gasparini & Kautonen, 2022). Although the use of AI innovations is raising ethical, legal, and social implications, including concerns around job displacement, bias, and privacy in recent times, AI applications are rapidly evolving, offering society, institutions, and organizations the opportunities for innovation, growth, and efficiency (Lund et al., 2020).

Knowledge and Use of AI in the Delivery of Library Services

AI (Artificial Intelligence) is becoming increasingly relevant in academic libraries due to its potential to improve library services and user experiences, creating a keen interest in acquiring knowledge among librarians (Lund et al., 2020). Information on AI is accessed from print and electronic sources of information. Studies by Majanja and Kiplang'at 2003, Aesaert and Van Braak 2015, and Yamson et al. 2018 reveal the preference for electronic resources among young adults and studies. The different ways in which AI technology has been implemented in academic libraries, evident in the literature, are discussed in this section.

- *Chatbots and Virtual Assistants:* Through chatbots and virtual assistants, libraries can assist their users in finding information, answering reference questions, and always provide support remotely and virtually. Virtual assistance provided through chatbots was beneficial to libraries during the outbreak of COVID-19 when lockdowns were enforced in most countries around the world to curb the spread of the coronavirus (Johnson, 2020; Donkor, 2021). While a study by Aklabi (2021) described how the King Saud University Libraries used virtual assistance to provide vital responses and information virtually and remotely to the satisfaction and admiration of their graduate students who were conducting research, Afrane et al. (2022) also report on how the integration of AI applications and tools has transformed the academic library spaces in some selected university libraries in Ghana. Both scholars mentioned how AI implementations in their information and

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learning commons facilitate research and learning collaborations and improve teaching and learning in the universities they studied.

- *Recommendation Systems:* AI algorithms can be used to analyze user behavior and recommend relevant resources, such as books, articles, and databases. Admissibly, human behavior analysis is a huge and daunting task especially when one needs that analysis to make informed decisions and provide adequate resources to users. In recent years, when most young and older adults turn to social media and the internet, Tariq et al. (2021) proposed an architecture to gather and analyse massive social media data using Big Data analytics mechanisms. Their proposed architecture is useful in monitoring and analyzing students' behavior and search preferences to predict their academic information needs.
- *Metadata Management:* AI can be used to enhance metadata records, making it easier for users to find the resources they need. AI-powered metadata uses artificial intelligence (AI) techniques to automatically generate, analyse and annotate metadata. Metadata is information that describes data, such as title, author, and keywords, and it is used to help users find, use, and understand data. AI-powered metadata can be generated in several ways. Natural language processing (NLP) algorithms are used to extract keywords, concepts, and other relevant information from the text (Tariq et al., 2021). This can be done by analyzing the content of documents, web pages, or other data sources. Another approach is to use computer vision algorithms to analyse images and videos and extract metadata from them, such as identifying objects, people, and locations in the visual content. AI-powered metadata can also be used to enrich existing metadata by adding new information or correcting errors. For example, AI can be used to identify missing or incorrect metadata in a database of images and videos and automatically update the metadata accordingly (Tsabedze et al., 2022). Overall, AI-powered metadata can help libraries manage large amounts of data more efficiently by automating the metadata generation and maintenance process. It can also improve the accuracy and completeness of metadata, which can help users find and use data more effectively.
- *Digital Preservation:* AI can help libraries preserve digital materials by identifying, classifying, and analyzing content to ensure long-term access and usability. AI technology can be used in digital archives to automate and improve various aspects of the archival process. Some of how AI can integrate into digital archiving, as outlined by Cushing and Osti (2022), are metadata generation; AI algorithms can be used to generate metadata for digital archives automatically. This can help improve the accuracy and completeness of metadata, as well as save time and resources that would be

required for manual metadata creation. Text recognition using AI algorithms can be used to recognize and transcribe text in scanned documents, making it searchable and easier to access. This can be particularly useful for historical archives that contain handwritten documents or other hard-to-read text. Image recognition with AI algorithms can be used to recognize and tag images in digital archives, making them easier to search and browse (Tariq et al., 2021). Content analysis with AI algorithms can be used to analyze the content of digital archives, identifying patterns, trends, and other insights that may not be apparent through manual analysis and can help to uncover hidden connections between different pieces of data or identify gaps in the archive that may need to be filled. Preservation algorithms can be used to monitor digital archives and detect potential risks to data integrity, such as hardware failures or software bugs to ensure that digital archives remain accessible and usable over time. Through AI technology, digital archives can be more efficient, accessible, and useful to researchers, scholars, and other users. The ethical and responsible way AI algorithms are developed and used is key, considering privacy, bias, and transparency issues (Lund et al., 2020).

- *Text Mining and Analysis:* Text mining and analysis use computational techniques to extract insights and information from unstructured or semi-structured textual data. This can include analyzing large collections of documents, social media posts, emails, customer feedback, and other types of textual data (Arshad et al., 2020). Through AI, large amounts of text and data can be analyzed, allowing libraries to identify patterns and trends that can inform collection development, research, and other technical areas. Tariq et al. (2021) argue that text mining helps organizations to gain valuable insights from textual data that would be difficult or impossible to obtain through manual analysis. They, however, caution on the importance of ensuring that the analysis is conducted ethically and responsibly, considering privacy, bias, and accuracy.
- *Intelligent Search:* Intelligent search uses advanced algorithms and artificial intelligence (AI) technologies to improve the accuracy, relevance, and efficiency of search results, unlike Traditional search engines, which rely on keyword-based searches, which can often return irrelevant or low-quality results. Intelligent search uses machine learning, natural language processing, and other AI techniques to understand the context and intent behind search queries and provide more personalized and accurate results (Fu et al., 2011). One of the key benefits of intelligent search is that it can adapt to the user's behaviors and preferences over time, making it easier to find the information they are looking for. For example, a search engine could learn which types of results a user clicks on most frequently and prioritize those types of results

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in future searches. This can save users time and effort and help them find the information they need more quickly. Intelligent search is used widely in e-commerce, enterprise search, and online advertising. AI algorithms can improve search accuracy and relevance, making it easier for users to find the needed information (Fu et al., 2011). AI can transform academic libraries by improving the quality and efficiency of library services, enhancing user experiences, and enabling librarians to focus on high-value tasks such as research support and instruction.

Skills and Competencies Needed for the Implementation of AI in Libraries

The implementation of AI in libraries requires a range of skills and competencies. Afrane et al. (2022) outlined some basic IT skills librarians require to improve their service delivery and learning. They mentioned that web design, management, and programming language were essential skills librarians needed in the current technological environment. Among the skills and competencies needed for the effective implementation of AI in libraries include:

- *Data Management and Analysis:* Libraries need staff with expertise in data management, including data cleaning, transformation, and analysis, to support the implementation of AI algorithms (Perrier et al., 2017). Data management involves various activities: collection, storage, retrieval, and sharing. Organizations should ensure their data is accurate, complete, up-to-date, and stored securely to protect it from unauthorized access or loss (Yoon & Schultz, 2017). Librarians building their skills in data management also need to comply with regulatory requirements related to data privacy and security (Frederick et al., 2019).
- *Programming and Technology:* Librarians and information professionals need skills in programming languages, such as Python or R, and familiarity with AI and machine learning tools and platforms (Afrane et al., 2022). Programming and technology are also closely linked to emerging fields of artificial intelligence (AI), machine learning, and data science. These fields require specialized skills and knowledge in programming and technology to develop algorithms, analyze data, and build intelligent systems. Programming and technology are critical in the development of modern software and applications. By staying current with the latest programming languages and technologies, librarians can create innovative and effective solutions for complex problems in the research and academic domain (Tariq et al., 2021).

- *Information Architecture:* Librarians need knowledge of information architecture, including metadata standards, taxonomy, and ontology development, to ensure that data and resources are structured and organized for AI algorithms (Huvila et al., 2016). Information architecture aims to create a clear and intuitive structure for information that allows users to conveniently find what they are looking for, understand the relationships between different pieces of information, and navigate through the content with ease. This involves identifying user needs and goals, creating a taxonomy or classification scheme, and designing the overall structure and navigation system (Robins, 2002).
- *User Experience Design:* Librarians need to understand user needs and have expertise in user experience design to ensure that AI applications are user-friendly and intuitive. With the user in mind, this involves designing digital products, such as websites, mobile apps, and software. It involves understanding the needs and goals of users and designing an interface that is intuitive, easy to use, and engaging, meets users' needs, and helps them accomplish their tasks efficiently and effectively to create a positive user experience. To accomplish this requires a deep understanding of user behavior, psychology, and technology (Yoon & Schultz, 2017).
- *Ethical and Legal Issues:* Librarians should be familiar with ethical and legal issues surrounding AI, including data privacy, bias, and accountability, to ensure that AI applications are developed and implemented ethically and responsibly. Ethical and legal issues are important considerations in librarianship, particularly when applying AI to their work. Librarians must be aware of the potential impacts of AI on their work, users, and society at large. Incorporating ethical and legal principles into their work, librarians can create products and services that are safe, inclusive, and beneficial to users (Bradley, 2022).
- *Communication and Collaboration:* Librarians must be skilled in communicating and collaborating to work effectively with IT staff, vendors, and other stakeholders in implementing AI applications in the library. Effective communication and collaboration are essential for librarians to provide high-quality services and resources to their users. By working together and communicating effectively, librarians can better understand and meet their users' needs and enhance the library's overall impact and user community (Bottorff et al., 2008). Implementing AI in libraries requires a multidisciplinary approach involving librarians and information professionals with diverse skills and competencies.

Prospects of AI on the Delivery of Service Quality and Customer Satisfaction

AI's impact on delivering quality service and customer satisfaction can be significant if implemented in academic libraries. These include:

- *Increased Efficiency and Speed:* A study by Bradley (2022) shows that AI-powered systems can help automate routine tasks, such as book recommendations or answering frequently asked questions in libraries, freeing up librarians' time to focus on more complex tasks. This can result in faster and more efficient services, increasing customer satisfaction. AI can automate the process of cataloging books and other materials, reducing the time and effort required for manual cataloging. This can be achieved through natural language processing and machine learning techniques which can extract key information from texts and classify them accordingly (Bradley, 2022). Also, AI-powered chatbots can handle routine patron queries such as checking library hours and renewing books, freeing up library staff to focus on more complex tasks. AI can also analyze library usage data to predict which books and resources are likely in demand, enabling libraries to allocate their resources better and plan for future needs (Yoon & Schultz, 2017).
- *Improved Personalization:* AI algorithms can analyze user behaviors and preferences to provide selective dissemination of information, personalized recommendations, and services, such as personalized reading lists or customized research support. This can enhance the user experience and increase customer satisfaction. AI can help libraries provide personalized book recommendations to patrons based on their reading history and preferences. This can improve the patron's experience and increase the likelihood of repeat visits (Robins, 2002).
- *Better Resource Management:* AI can assist with managing library resources, such as recommending the most popular resources, identifying the most relevant materials, and managing inventory. This can improve the quality and availability of resources, leading to higher customer satisfaction. AI-powered natural language processing can help libraries improve search functionality, making it easier for patrons to find the necessary books and resources. AI can automate sorting returned books, reducing the time and effort required for manual sorting (Fu et al., 2011).
- *Enhanced User Experience:* AI can improve the user's experience by providing support, answering questions promptly and accurately, and providing customized services based on user preferences. This can result in higher customer satisfaction and loyalty. AI has also helped libraries to

enhance the user experience by providing personalized and efficient services, making it easier for users to find and access the resources they need (Cushing & Osti, 2022).

- *Reduced Errors and Bias:* AI can reduce errors and bias in the delivery of library services by automating tasks and providing consistent and objective responses. This can improve service quality and lead to higher customer satisfaction. AI algorithms can make decisions without human intervention, reducing the potential for human error or bias. AI also has the potential to reduce errors and biases in various fields by providing more accurate and consistent results and detecting and eliminating errors and biases in data and processes (Pannucci et al., 2010).
- *Greater Collaboration:* AI can facilitate collaboration among librarians, researchers, and students, by providing real-time insights and data analysis. AI-powered recommender systems can suggest resources to users based on their interests and needs. This can encourage collaboration between users with similar interests and lead to new resources discovery. AI can analyze data on library usage and resources to identify patterns and trends. Such information can be used to improve library services and resources, encouraging collaboration between users. AI has the potential to enhance collaboration in libraries by providing personalized services, freeing up staff time, and improving access to resources. This can encourage librarians and users to work together and collaborate on projects, leading to increased knowledge sharing and innovation (Pham & Tanner, 2015).
- *Advancement in Research:* Artificial intelligence (AI) is transforming libraries by enhancing their ability to collect, organize, and analyze vast amounts of data, making research more efficient and effective. AI can enable new research and discoveries by analyzing data sets that would be too large or complex for humans to analyze manually. With AI, libraries can extract useful insights from vast amounts of data quickly and accurately. AI algorithms can analyze a researcher's preferences and recommend relevant articles, books, and other resources. This helps researchers find information they may have missed or overlooked, leading to more comprehensive research. This also helps researchers access relevant information quickly, making the research process more efficient. AI tools can analyze large volumes of text, including books, journals, and research papers, to identify patterns, trends, and relationships that may be difficult to spot manually. This can help researchers identify new research areas or find connections between seemingly unrelated topics (Bottorff et al., 2008).

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Notwithstanding, there are also potential drawbacks to using AI in library services, such as concerns about privacy, data security, and ethical considerations. It is essential to consider the potential risks and benefits of AI in library services and to implement AI systems ethically and responsibly to ensure they enhance the quality of library services and customer satisfaction.

Implications of AI in Libraries

In as much as the use of AI offers libraries diverse prospects, there are several implications and challenges to its use in libraries, including:

- *Ethical and Legal Issues:* AI raises ethical and legal concerns related to data privacy, bias, and accountability. Libraries are to ensure the ethical and responsible development and implementation of AI, not to perpetuate and even amplify existing societal prejudices and discrimination. For instance, facial recognition technology has been found to have higher error rates for people of color and women, bringing up concerns about racial and gender biases. Again, AI systems can collect and analyze large amounts of personal data, raising privacy and data protection concerns (Hussain, 2023). Organizations should observe transparency about collecting and using data and protecting and safeguarding the rights and privacy of the people they serve and interact with. Many AI systems are considered “black boxes” because their decision-making processes are not transparent or explainable. This lack of transparency can make it difficult to hold organizations accountable for their decisions and erode public trust in AI. AI systems can generate and manipulate intellectual property, raising questions about ownership and control over these assets (Okunlaya et al., 2022).
- *Workforce Displacement:* The use of AI in libraries may lead to the displacement of some jobs that can be automated, such as data entry or book recommendations. It is important to consider the potential impact on the workforce and plan appropriately to overcome resistance and apathy to change. AI can automate repetitive and routine tasks, such as data entry, customer service, and basic analysis, which humans currently perform. This can lead to job displacement, particularly in industries where these tasks are prevalent. The effect of AI in the workplace is complex and multifaceted. While its implementation will likely displace workers, it can create new job opportunities and competitive advantages for organizations. Therefore, policymakers, employers, and workers must anticipate and adapt to these changes to ensure a smooth transition to the new technological landscape (Țundrea et al., 2020).

- *Technical Challenges:* Implementing AI requires significant technical expertise, and there may be challenges related to integrating AI with existing library systems. AI systems can be vulnerable to cyber-attacks, and organizations should implement the necessary safeguards to protect their systems from hacking and other malicious activities. AI algorithms require large amounts of high-quality data to train effectively. However, obtaining such data can be difficult and time-consuming. Moreover, the data quality can affect the accuracy and reliability of the AI model. AI algorithms can be biased and unfair if the data used to train them is not objective. This can result in discriminatory outcomes, which can affect people in society. Addressing bias and fairness is a significant technical challenge for AI (Farag et al., 2021).

Notwithstanding the challenges of implementing AI in organizations, academic libraries can leverage its advantages of improved efficiency, enhanced user experience, and capabilities to advance its user community's teaching, learning and research pursuits.

METHODOLOGY

The quantitative research method guided this study. Using the survey approach, the population and sample were determined. The population for the study consisted of all fifteen (15) public universities in Ghana since they produce a chunk of the nation's human resources. The researchers designed the questionnaire with insight from the literature and distributed it among librarians of the sampled university libraries. The questionnaire consisted of five sections consisting of open-ended and close-ended questions. Section A collected Demographic information on respondents, Section B: Awareness of the emergent use of AI in libraries, Section C: Awareness of AI Applications in Academic Libraries, Section D: Perception of the application of AI in academic libraries, Section E: Use of AI in service delivery in Academic libraries and Section F: Skills and competencies of librarians in the implementation of AI in services and Section G: Challenges in adopting AI in academic library services delivery. The link to the Google form was distributed electronically to librarians from January 2023 to the middle of February 2023.

DATA ANALYSIS AND FINDINGS

One hundred fourteen (114) questionnaires were completed, returned, and used in data analysis. Data collected using the questionnaire was cleaned, coded, and

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analyzed using the Statistical Package for Social Sciences (SPSS) Version 26 to obtain descriptive and inferential analyses.

Demographics

Table 1 shows that 79 (69.3%) of the study respondents were females, and 35(30.7%) were males.

Table 1. Gender of respondents

Gender	<i>n</i>	%
Male	35	30.7
Female	79	69.3
Total	114	100.0
Educational Level	<i>n</i>	%
BA in Information Studies/Equivalent	42	36.8
MA in Information Studies/Equivalent	26	22.8
MPhil in Information Studies/Equivalent	21	18.4
PhD in Information Studies/Equivalent	11	9.6
Diploma	14	12.3
Total	114	100.0

Also, enquiring about the educational level of respondents, it is evident from Table 1 that 42 (36.8%) of the respondents had a Bachelor's Degree in Information Studies and its equivalent. Twenty-six (22.8%) had a Master's Degree in Information Studies and its equivalent, 14 (12.3%) had a Diploma in Information Studies and its equivalent, and 21 (18.4%) had a Master of Philosophy Degree, and 11 (9.6%) had a Doctor of Philosophy Degree in Information Studies and its equivalent.

Knowledge and Perception of Librarians' Use of AI in Academic Libraries

The study's first objective was to assess the knowledge and perception of librarians' use of AI in Academic libraries. To do so, the following sub-objectives were assessed.

- i. Knowledge of the emergence of AI in libraries
- ii. Source of knowledge on AI tools and applications
- iii. Perception of librarians of the use of AI in Academic libraries

H1: to determine the relationship between one's level of education and their source of knowledge of AI in Academic Libraries

H2: to determine the relationship between the level of education and the frequency of one's knowledge acquisition.

KNOWLEDGE OF THE EMERGENCE OF AI

Librarians' knowledge of the emergence of AI was assessed. Table 2 revealed that all 114(100.0%) respondents indicated they knew about AI in academic libraries.

Table 2. Awareness of artificial intelligence tools and applications

	<i>n</i>	%
Yes	114	100.0

Source of Knowledge on AI Tools and Applications

Probing further the source of librarian's knowledge of AI tools and applications was assessed to reveal that the majority, 55 (48.2%), obtained their knowledge from Research Articles, 33(28.9%) from Workshops/symposiums/webinars and 26(22.8%) from Formal education as indicated in Table 3.

Table 3. Source of knowledge on AI tools and applications

	<i>n</i>	%
Formal education	26	22.8
Workshops/symposiums/webinars	33	28.9
Research articles	55	48.2
Total	114	100.0

H1: To Determine the Relationship Between One’s Level of Education and Their Source of Knowledge of AI in Academic Libraries

To ascertain if there exists a relationship between education and one’s source of knowledge on AI, a collection analysis between respondents’ educational level and the source of their knowledge was assessed. It was revealed that educational level has a significant positive ($r= 0.3, p<0.01$) relationship with the sources of knowledge on AI tools and Applications. This means the sources of knowledge on AI tools increase as librarians acquire higher education and vice versa.

Table 4. Correlations between education and source of knowledge

	Educational Level	Source of Knowledge on AI Tools and Applications
Educational level	1	0.396**
Source of knowledge on AI tools and applications	0.396**	1

** . Correlation is significant at the 0.01 level (2-tailed).

Frequency of Knowledge Acquisition on the Application of AI in Academic Library Services Provision

The frequency at which respondents acquired knowledge on the application of AI in academic libraries was assessed. Table 5 revealed that a majority, 76 (66.7%), often read about the application of AI in academic libraries, while 2 (1.8%) always read about AI in academic libraries. Twenty-eight (24.6%) respondents sometimes acquired knowledge of the application of AI, while 4 (3.5%) respondents each never and rarely acquired knowledge of AI.

Table 5. Frequency of knowledge acquisition on the application of AI in academic library services provision

	Frequency	Percent
Never	4	3.5
Rarely	4	3.5
Sometimes	28	24.6
Always	2	1.8
Often	76	66.7
Total		114

H2: To Determine the Relationship Between Educational Level and the Frequency of One’s Knowledge Acquisition

Again, a correlation analysis was conducted to ascertain if a relationship exists between educational level and the frequency of one’s knowledge acquisition. A correlation analysis was conducted to ascertain the relationship between educational level and the frequency of knowledge acquisition on the application of AI in academic library services provision was assessed. Results indicated a positive significant relationship ($r= 0.533$, $p<0.01$) between educational level and the frequency of knowledge acquisition on the application of AI in academic library services provision. This means the more one gets educated, the more he acquires knowledge on applying AI tools in academic libraries.

Table 6. Correlation analysis between educational level and frequency of knowledge acquisition

	Educational Level	Frequency of Knowledge Acquisition on the Application of AI in Academic Library Services Provision
Educational level	1	.533**
Frequency of knowledge acquisition on the application of AI in academic library services provision	.533**	1

** . Correlation is significant at the 0.01 level (2-tailed).

Perception of Librarians of the Use of AI in Academic Libraries

Assessing the perception of librarians of the use of AI in Academic libraries, the Mean and Standard deviation results from Table 7 showed that a majority (Mean=4.3684, SD=0.66868) agreed that AI Tools would improve service provision to users in academic libraries. Again, a large majority (Mean=4.3333, SD=0.73673) agreed that applying AI tools will improve their work efficiency in academic libraries. A majority (Mean=4.3158, SD=0.75628) also agreed that AI tools would enable quick and efficient retrieval of information for users.

PERCEPTION OF LIBRARIANS ON THE IMPORTANCE OF AI IN ACADEMIC LIBRARIES

Additionally, while a majority (Mean=4.2193, SD=0.83887) agreed that the implementation of AI would enhance the work of librarians, another majority (Mean=3.9561, SD=0.93497) agreed that AI would increase the patronage of the library, however (Mean=2.9123, SD=1.31406) were neutral of the view that the application of AI will take over their jobs and make them redundant.

Table 7. Perception of librarians of the use of AI in Academic libraries

	Mean	Std. Deviation
AI Tools will improve service provision to users in academic libraries	4.3684	0.66868
AI tools will improve the efficiency of my work in academic libraries	4.3333	0.73673
AI tools will enable quick and efficient retrieval of information for users	4.3158	0.75628
AI will increase the patronage of the library	3.9561	0.93497
AI will take over jobs and make people redundant	2.9123	1.31406
AI will enhance the work of librarians	4.2193	0.83887

Use of AI in Academic Libraries

The study's second objective was to assess the use of AI in service delivery in Academic libraries. The study revealed that a majority did not know the use of Pattern Recognition for the acquisition, processing of books, and circulation of library materials used in your library (Mean=1.8421, SD=0.36625). Another majority (Mean= 1.7895, SD=0.40948) also disagreed that they knew about using Chatbot for reference services (Alexa, Siri, and IBM Watson) in your library. Another majority (Mean=1.7281, SD=0.44692) were not knowledgeable about Big Data Analytics to manage library digital data processing, database usage, and the sharing of data used in your library.

Again, Table 8 shows that the majority (Mean=1.7193, SD=0.45133) disagreed with the use of Natural Language Processing in Voice Search and Search Assistance of library and online materials used in your library. Another majority (Mean=1.6491, SD=0.47935) disagreed with Robotics for shelving and retrieving books used in your library. The majority (Mean=1.5965, SD=0.49277) each disagreed that Text Data Mining for citation counts, Altimetric scores, library trends, social media Tagging, etc. used in your library and Expert Systems for the effective management of the system library used in your library.

Table 8. Knowledge of the uses of AI in academic libraries

	Mean	Std. Deviation
Expert Systems for the effective management of the system library used in your library	1.5965	0.49277
Natural Language Processing in Voice Search and Search Assistance of library and online materials used in your library	1.7193	0.45133
Chatbot for reference services (Alexa, Siri, and IBM Watson) used in your library	1.7895	0.40948
Pattern Recognition for acquisition, processing of books, and circulation of library materials used in your library	1.8421	0.36625
Big Data Analytics to manage library digital data processing, database usage, and the sharing of data used in your library	1.7281	0.44692
Text Data Mining for citation counts, Altimetric scores, library trends, social media Tagging etc., used in your library	1.5965	0.49277
Robotics for shelving and retrieving books used in your library	1.6491	0.47935

Prospects and Implications of AI in Academic Libraries

The third objective of the study was to assess the prospects and implications of AI in academic libraries. In doing so, it was revealed that a majority (Mean=4.3860, SD=0.54055) agree that Pattern Recognition will enhance the acquisition, processing of books, and circulation of library materials. Again, a majority (Mean=4.3158, SD=0.62847) agreed that Big Data Analytics enhances the management of library digital data processing, database usage, and data sharing. Results also revealed that Robotics would enhance shelving and the retrieval of books (Mean=4.2632, SD=0.85241).

Again, a majority (Mean=4.2105, SD=0.75813) agreed that Text Data Mining would enhance information collection on citation counts, Altimetric scores, library trends, social media Tagging, etc. Another majority (Mean=4.2456, SD=0.73547) agreed that Chatbot would enhance reference services (Alexa, Siri, and IBM Watson). Another majority (Mean=4.2368, SD=0.75613) agreed that Expert Systems would assist in making effective organizational management decisions for the system library. Another majority (Mean=4.1053, SD=0.86596) agreed that Natural Language Processing in Voice Search and Search Assistance would enhance the searching and retrieval of library and online materials. Yet, another majority (Mean=4.0088, SD=1.02617) agreed that Robotics would guide weeding decision-making, as shown in Table 7.

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Table 9. Prospects and implications of AI in academic libraries

	Mean	Std. Deviation
Expert Systems will assist in making effective organizational management decisions for the system library	4.2368	0.75613
Natural Language Processing in Voice Search and Search Assistance will enhance the search and retrieval of library and online materials	4.1053	0.86596
Chatbot will enhance reference services (Alexa, Siri, and IBM Watson)	4.2456	0.73547
Pattern Recognition will enhance the acquisition, processing of books, and circulation of library materials	4.3860	0.54055
Big Data Analytics enhance the management of library digital data processing, database usage, and the sharing of data	4.3158	0.62847
Text Data Mining will enhance information collection on citation counts, Altmetric scores, library trends, social media Tagging, etc.	4.2105	0.75813
Robotics will enhance shelving and the retrieval of books	4.2632	0.85241
Robotics will guide weeding decision making	4.0088	1.02617

DISCUSSION OF FINDINGS

This study was conducted to assess librarians' knowledge of the emergence of AI, their perception of the use of AI in academic libraries in libraries, and their source of knowledge of AI tools and applications in academic libraries. The study involved 114 respondents, with a majority of 79 (69.3%) being females and 35 (30.7%) being males. This can be attributed to the fact that the information studies and librarianship profession is female-dominated (Majanja and Kiplang'at, 2003). The educational level of the respondents varied, with the majority having a bachelor's degree in information studies (36.8%), followed by a Master's degree (22.8%) and a Diploma in Information Studies (12.3%).

Results indicated that all 114 respondents knew about the emergence of AI in academic libraries. The majority of librarians obtained their knowledge from research articles (48.2%), followed by workshops/symposiums/webinars (28.9%), and formal education (22.8%). Research articles being the chief source of information on AI among librarians can be attributed to them knowing that such articles contain up-to-date information on research and studies carried out in the field. Again, these research articles may be in their subscribed journal and databases and will have ready and easy access. The proliferation of technology has pushed librarians and individuals to prefer electronic information sources compared to their print counterparts. This finding corroborates with studies by Batool and Ameen (2010), Aesaert and Van Braak (2015), and Yamson et al. (2018).

Regarding perception, the librarians generally agreed that AI tools would improve service provision to users (Mean=4.3684, SD=0.66868), improve work efficiency (Mean=4.3333, SD=0.73673), and enable quick and efficient retrieval of information for users (Mean=4.3158, SD=0.75628). This finding confirms studies by Bradley (2022), Yoon & Schultz (2017), and Robins (2002), who believe AI implementation will enable librarians to provide effective and satisfactory services to their user community.

Again, while most agreed that the implementation of AI would enhance the work of librarians (Mean=4.2193, SD=0.83887), some agreed that AI would increase library patronage (Mean=3.9561, SD=0.93497). A study by Robins (2002) suggested that the implementation of AI in academic libraries will make it possible for librarians to provide personalized services such as selective dissemination of information and personalized research support, among other services customized to meet the specific needs of their users which will eventually draw more users to the library.

The study also showed that some librarians were, however, neutral about the view that the application of AI would take over their jobs and make them redundant (Mean=2.9123, SD=1.31406) and could be attributed to the novelty of the AI technologies and applications and the uncertainties that surround its implementation.

Results further indicated that librarians generally had little or no knowledge of the use of Pattern Recognition for the acquisition, processing of books, and circulation of library materials (Mean=1.8421, SD=0.36625), Chatbot for reference services (Mean=1.7895, SD=0.40948), Big Data Analytics to manage library digital data processing, database usage, and the sharing of data (Mean=1.7281, SD=0.44692), Natural Language Processing in Voice Search and Search Assistance of library and online materials (Mean=1.7193, SD=0.45133), Robotics for shelving and retrieving books (Mean=1.6491, SD=0.47935), Text Data Mining for citation counts, Altmetric scores, library trends, social media tagging, etc. (Mean=1.5965, SD=0.49277), and Expert Systems for the effective management of the system library (Mean=1.5965, SD=0.49277). This generally low knowledge of the users of AI applications in academic libraries can be attributed to the fact that most libraries have not implemented AI. However, it confirms the initial revelation from the study that AI knowledge was acquired primarily through research articles limiting their practical knowledge of AI applications and tools. This confirms a study by Afrane et al. (2022) which suggested that librarians and information professionals needed to build their skills and capacity in programming languages, such as Python or R, and their familiarity with AI and machine learning tools and platforms.

CONCLUSION AND RECOMMENDATIONS

The study sought to assess the knowledge and perception of librarians who worked in academic libraries in Ghana's use of AI in academic library services provision. The study revealed that librarians in Ghana generally had a positive perception of using AI in academic libraries, but their knowledge of AI tools and applications was limited. The study also revealed a significant positive relationship between educational level and the sources from which information on AI was sought, with research articles being the most sought-after information source. The study recommends that librarians be exposed to AI tools and applications through workshops, training, and further education to fully utilize AI's potential benefits in academic libraries. Academic libraries are encouraged to invest in AI tools and applications to leverage their advantages.

LIMITATIONS AND FUTURE RESEARCH

Artificial Intelligence is a broad and emerging technology. This study looked at librarians' knowledge and perception of the use of AI in the delivery of academic library services, thereby limiting the extent to which the researchers could delve into the use of AI applications in academic libraries. Further research into implementing AI tools and applications in delivering the different library services is appropriate and recommended.

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KEY TERMS AND DEFINITIONS

Academic Libraries: Academic libraries are libraries that are affiliated with academic institutions such as colleges and universities. These libraries support the research and academic activities of their institution by providing access to a wide range of resources, including books, journals, databases, and other materials.

Artificial Intelligence: Refers to the development of computer systems that can perform tasks that would typically require human intelligence to accomplish. These tasks may include visual perception, speech recognition, decision-making, and language translation. AI systems can be programmed to learn from experience and adapt to new situations, which allows them to continually improve their performance.

Chatbots: Chatbots are computer programs designed to simulate conversation with human users through text or voice-based interfaces. Chatbots use natural language processing (NLP) to understand and interpret user input and generate appropriate responses.

Library Assistant: A library assistant is a support staff member who works in a library to help with a variety of tasks related to library operations.

Library Services: Library services refer to the various services and resources provided by libraries to support the needs of their users.

Metadata: Metadata is information that describes data, providing additional context and meaning to help users understand and manage the data.

Natural Language Processing: A subfield of artificial intelligence that focuses on enabling computers to understand, interpret, and generate human language. It involves a range of techniques and tools used to process and analyse human language data, including text, speech, and even images or videos with textual content.

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Text Mining: Text mining is the process of analysing and extracting useful information from unstructured text data. It involves using machine learning and natural language processing techniques to automatically identify and extract patterns, relationships, and insights from large volumes of text data.