Artificial Intelligence in Transforming Academic Library Services of Higher Education Institutions

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Abstract

The growth of India's university system has been rapid because of globalization. No other sector has been more affected by research, development and global competitiveness than education development. It has been able to change the field of education through the usage of ICT. In educational institutions, innovation is not only about studying. It is about delivering quality educational experiences for students. Libraries and information centers (LICs) are of great importance in the development of educational institutions such as universities and colleges. Library networks and consortia have an important role to play in helping to alleviate the financial crisis facing libraries and information centers. Our country is a developing one and this study examines how academic libraries are responding to the increased demands upon them. This study mainly discusses the role of academic libraries in higher education. There is a great movement going on in the system of higher learning in India. India today has the third highest student population in the world and the most institutions per capita, thanks to its huge higher education system. Education should ultimately aim at the full development of each child. This stage of growth requires students to take courses in the arts, sciences, computer science, literature, and the humanities. A well-staffed and properly maintained library is the foundation of any modern educational institution. The library is the primary mechanism of collecting and utilizing our knowledge base. "Libraries need to be well stocked to make formal education effective and efficient.".

Keywords: *Higher Education, ICT, Libraries, MHRD, UGC.*

INTRODUCTION

The rapid progress of artificial intelligence (AI) has massively influenced various areas like education, healthcare, banking, and transportation. As digital transformation accelerates, AI is emerging as a useful tool for educational institutions to increase operational efficiency and provide customized services. University libraries have become important places for technological development in this context as the hub of academic resource access and knowledge dissemination. Artificial intelligence (AI) technologies are starting to change the way libraries operate in a number of ways including automating cataloging systems, digitization, intelligent search algorithms and virtual assistant tools that improve user satisfaction and service responsiveness. These ad van cements also speed up service delivery and free up individuals to do specialized responsibilities such as managing digital collections and assisting advanced research. Despite these technological advantages, the effective implementation of AI in the libraries of higher education institutions relies heavily on user acceptability, notably on the part of students and staff. It is crucial to know how users perceive, expect and are concerned about artificial intelligence (AI) technologies before they are extensively adopted in academic contexts.

The acceptability of AI-driven solutions depends on the alignment of user needs with technological capabilities, attitudes and ethical considerations. To build trust and ensure ethical deployment, issues regarding data privacy, algorithmic transparency and less human interaction need to be addressed. It is important to understand the experience and viewpoints of users to inform the appropriate and effective usage of AI in academic libraries.

Human culture is important to education. One of the great things about education is how fast it changes as teaching and learning change. Learning today is more participatory. Students that are active in the learning process retain more information. Higher education (HE) enhances the skills and the scope of knowledge of an individual. New ways improve creative work. In the recent decade or so, a number of novel methods to education have arisen, including deep learning, virtual learning, social-emotional learning, shadow schooling, machine learning and lifelong learning (LLL). The dizzying velocity of global change is mostly driven by improvements in the quantity and quality of education and the rate of learning. “We also need an education that guides life. HE has been important in developed nations.

Modernization and improvement have promoted the quality of higher education to higher levels. The government has provided funds to qualifying higher education institutions to promote the development of these institutions into renowned centers of learning. The reform of the education system in India is mostly due to electronic resources and Information and Communication Technology (ICT) enabled schooling. funded & regulated by University Grants Commission (UGC). NAAC has been assessing and certifying higher education institutions. Recently, the Ministry of Human Resource Development (MHRD) launched the National Institutional Ranking Framework (NIRF) to rank the universities and colleges in the country. Another program of the MHRD, the All India Survey on Higher Education (AISHE) is useful for the planning of the educational sector as it collects information about HE institutions. Such programs are assisting educational institutions in raising the bar on quality and developing competitive strategies. Library services are at the heart of higher education institutions and are going through a digital transformation as the industry as a whole is changing.

ROLE OF ACADEMIC LIBRARIES IN HIGHER EDUCATION

The Indian higher education system is the largest in the world, second only to China and the US. The main governing organization at tertiary level is the University Grants Commission, which gives advise on policy, maintains standards and helps federal and state authorities collaborate. Since independence India has witnessed a dramatic expansion in the number and quality of higher education and library services. College libraries are actively involved in the information age by extending digital resources for students and spreading knowledge to the general public. Academic libraries need to collect and organize the contents effectively to cater the educational, recreational and research needs of research scholars, students, faculty and community users. They also have a responsibility to provide enough information resources and guidance in their use. The new digital resources have let the learning community to access materials regarding the development of ICT anytime they require and at any time. Orientation is one method the library meets these goals, particularly for first-year students. That happens once a year, in January. The intention is to inform new people about the wonderful library services on offer. All new year students are required to attend orientation at the school.

RECENT TRENDS IN HIGHER EDUCATION

Information and communication technologies have been introduced fast in higher education. Digital technology is slowly taking over the old ways of operating across the globe. Electronic devices and e-administration are very significant in our everyday life and have changed the mindsets of the younger generations. This is true not only when it comes to standard education but also in the domains of commerce, economy and administration. Digital libraries were initially introduced to the general public some twenty years ago. In addition, they have been growing rapidly in the last few years. The characteristics of digital libraries are the following: they are always present, both geographically and in time; they store, maintain, distribute and protect contents in different formats; at the same time they allow an interaction between the user and the contents (materials); they are always present.

Multimedia Educational Resource for Learning and Online Instruction

Works can be made known at a global scale, improving the quality of references and citations; outputs of the educational process can be made public and permission to use them as inputs for future learning can be given. Digital libraries can be effectively used for the management of courseware and other reference materials used in the classroom. Since digital libraries are normally connected to the Internet, contents from different cooperating institutions can be used. This is possible as long as the LOs are documented (metadata) and maintained effectively. The digitalization of the libraries provides a great advantage of cross-institutional cooperation. MERLOT (Multimedia Educational Resource for Learning and Online Teaching) is a premier, user-centered, searchable collection of peer-reviewed, higher education, online teaching and learning materials contributed by an international education community of registered members, as well as a set of faculty development support services. The organization's mission statement is contained on the organization's website. The impact of electronic technology was felt almost instantly. Libraries and information centers are likewise not too far behind in the usage of automated technology. Publications such as books, journals, periodicals, and other printed materials have been replaced by electronic resources and digitalized services such as "Ask A Librarian services", online, chat reference, video conferencing, digital robots, and collaborative digital reference, etc.

Institutions of Higher Education and Libraries

The library is a vehicle for the current flow of ideas as well as a storehouse for final collections of information that can be stored irrevocably for future generations. It is a way of talking with one another. It is essential communication; it is still discourse that is unclear. Sometime in the future, after the excitement is mostly over and the issue has been well worked, it will, in the main, be incorporated in writings that are called treatises. A library is an institution which provides services. Library services are one of the most used and understood services in modern society. The academic community, and a university in particular, uses library services for two main purposes: research and instruction. The library backs academic work. In this context, it is rightly said that the library is the heart of an educational institution. From this, we may describe the concept of library as a library as an institution that makes available in one place a reader can consult and obtain the knowledge they are looking for. In this respect universities are institutions which assume the exclusive duty for higher education and for the transmission of information, which is crucial to the growth of human personalities and individual nations.

The function of the library in relation to the function of the university. Employ a library development programr in accordance with this definition. As Dr. S. R. Ranganathan says, “Libraries are not mere storehouses but they are plenty of wells from which knowledge flows to irrigate the field of education and culture”. The fundamental function of the university library is to offer educational opportunities. It must not be conducted as a mere book store, adjunct to a reading room, but should be used as an efficient educational tool. This point has been stressed in a number of studies published by various library and educational commissions in India and other countries. The main function of a university library is to facilitate the successful achievement of numerous objectives including, but not limited to teaching, research, publication programming, etc. The university library has enormous obligations in the contemporary education system and it is imperative that these roles be transformative.

The Transformation of Library Services through Artificial Intelligence

AI is quite likely to transform service delivery in many critical areas of library operations. The automation technique has helped in making ordinary library administration jobs easier and helped the staff members to concentrate on operations that are timely. Automated bibliographic systems, using high-speed processing, can analyze large volumes of data and provide users access to the most recent research material. The application of artificial intelligence systems in academic libraries improves operational efficiency. These tools provide personalized recommendation systems, predictive search and automated literature review services. Artificial intelligence-powered chatbots and virtual assistants can transform how library users interact with service providers by offering live solutions to their questions, thereby increasing user happiness.

Objectives of The Study

1. To evaluate how happy library users are with AI-enhanced facilities.
2. To find out the difficulties and obstructions that arise while attempting to use artificial intelligence techniques in libraries.

Hypothesis of The Study

1. H1: Users are satisfied with AI-enhanced library services.
2. H2: Libraries face challenges in implementing AI technologies.

Limitations of Existing Studies

The study of introducing AI into Library Systems The study of introducing AI into Library Systems has started to grow but there are still some limitations in the current study. Many studies are theoretical or investigation based rather than application-focused in the field of AI technologies. That libraries are striving to create awareness and policy on AI, they did not find strong evidence of the use of advanced technologies of AI that have already been implemented in the activities of Academic libraries.

Research Gap

The recent publications of research work have focused on Ways in which Artificial Intelligence (AI) is becoming an increasingly significant influence in changing the way information services and libraries are functioning today. However, there are some gaps in the existing relevant literature regarding the overall contribution that standard artificial intelligence may make to the development of library services. The study

plan seeks to address this gap by investigating the means by which artificial intelligence can be leveraged to improve library services and the potential of artificial intelligence (AI) technologies to increase the efficiency and effectiveness of modern library systems..

Research Methodology

In this present study descriptive quantitative research models are used to find out the impact of Artificial Intelligence on the improvement of library services. In the light of the prevailing conditions, the descriptive research approach is the most appropriate method to employ since it will be geared toward identifying the extent to which the use of artificial intelligence is seen to be useful in improving library services and whether or not it is in use. The aim of this project is to explore the significance of AI based technologies in information retrieval, resource management, user support and overall development of library services.

Study Area

For this study the researchers visited different types of libraries viz., academic libraries, public libraries, institutional libraries etc. in Lucknow. The libraries are meant to serve a wide range of clients, including students, researchers, faculty, and members of the general public. The research project was located in the city of Lucknow which was picked as the location for the large number of libraries in the city. These libraries serve a wide range of service types and user groups and have a strong understanding of how Artificial Intelligence can be used to improve the delivery of library services.

Population of the Study

The study was conducted on the library professionals and the library users who were the regular visitors to the library in Lucknow. The intended audience was:

- Librarians
- Library staff members

External readers and visitors are those who are not part of the library but come to read books and get information. Respondents were selected for their first-hand experience with library services and their ability to share their views about the impact that artificial intelligence technology have made on the library. Methods of Sampling and Sample Size The study is extensive and includes the opinions of both library professionals and library users.

Data Collection Procedure

The research was carried out by use of the offline survey approach. In some Lucknow libraries respondents were asked to fill the questionnaires and hand over to the researcher. These questionnaires were given to the respondents. The survey respondents were contacted at the library’s location and asked to complete the questionnaire. They were given information on the purpose of the study before the questionnaire was administered to ensure that they were fully informed. To guarantee that the answers they gave were objective, the participants were offered the opportunity to take part in the study and to fill out the questionnaires in total anonymity. Out of 180 responses, only 180 were considered as legitimate and were to be used in the final data analysis.

Data Analysis Techniques

- Methods of descriptive statistics were utilized in the processing of the collected data. Included in the analysis were:
- The frequency distribution is used to describe the features of the demographic
- The modification of the ratings for each individual question.

The mean score analysis is used to analyze the feelings of the respondents toward the given artificial intelligence based library services. The results were presented in an efficient and clear manner using tabular and graphical displays like bar charts and pie charts. Statistical analysis was performed using the help of SPSS.

Ethical Considerations

A number of ethical norms were adhered to during the course of the investigation. Participants were given the opportunity to engage in the survey of their own free will, and they were given the assurance that the survey would be kept confidential. The information that was acquired was utilized in the field of study from the academic community.

RESULTS AND DISCUSSION

This section discusses the findings of the study conducted on a total of 180 respondents interviewed in libraries in Lucknow. The survey will concentrate on the level of knowledge, availability of Artificial Intelligence (AI) and the impact AI has on the improvement of library services.

Demographic Profile of Respondents

Table 1 provides a breakdown of the demographic data of respondents. The results revealed that out of 180 respondents, forty (22.22%) were librarians, fifty (27.78%) were library staff and ninety (50%) were readers or visitors who were not librarians. The number of external readers is higher than the number of internal readers, indicating that the library user is a large population that interacts with the services provided by the library. The involvement of both professionals and users will assure that the research will be undertaken on a variety of viewpoints related to the prospective application of artificial intelligence technology in libraries.

The following distribution reinforces the idea that libraries serve a large number of stakeholders and that the implementation of artificial intelligence technologies should consider the requirements of the people who create AI and the people who use it.

Table 1. Statistical Analysis of the Respondents' Demographics

Respondent Category	Frequency (f)	Percentage (%)
Librarians	40	22.22
Library Staff	50	27.78
External Readers / Visitors	90	50.00
Total	180	100

Artificial Intelligence in Libraries:

Table 2 shows the distribution of awareness of artificial intelligence in libraries in the following categories. A total of 74 respondents (41.11%) indicated moderate level of awareness about artificial intelligence technology whereas 52 respondents (28.89%) indicated high level of awareness. Contrary to the above, 36

respondents (20%) showed a moderate comprehension of the topic. 18 respondents (10%) did not have any information about the application of artificial intelligence technologies in library services. The results show that different players in the library sector are becoming aware of the concept of artificial intelligence in libraries. However, the low knowledge shown by some of the respondents shows that there is a need for training programs, workshops and awareness initiatives to promote understanding of artificial intelligence based technologies in libraries.

Table 2. Understanding of the Role of Artificial Intelligence in Libraries

Awareness Level	Frequency	Percentage (%)
Highly Aware	52	28.89
Moderately Aware	74	41.11
Slightly Aware	36	20.00
Not Aware	18	10.00
Total	180	100

This table is used for descriptive statistics.

Libraries Provide Tools for Artificial Intelligence

Table 3 provides an overview of the availability of artificial intelligence technologies in libraries. The most widespread form of AI equipment in libraries was artificial intelligence-based search systems, with sixty respondents (33.33 percent) utilizing them. Forty-four respondents (24.44 percent) were able to recognize automated cataloging systems whereas just thirty-two respondents (17.78 percent) were able to identify chatbots or virtual assistants. Further, twenty-eight respondents (15.56 percent) claimed that their libraries have recommendation systems. Sixteen respondents (8.89 percent) said that they do not have artificial intelligence capabilities. The results indicate that the integration of artificial intelligence technology is gradually becoming an important aspect of library management. Obviously, today's libraries are trying to better information retrieval and resource management. There are artificial-intelligence powered search engines and automated cataloging.

Table 3. AI Tools Available in Libraries

AI Technology	Frequency	Percentage (%)
AI-based search systems	60	33.33
Chatbots / Virtual assistants	32	17.78
Automated cataloguing	44	24.44
Recommendation systems	28	15.56
No AI tools	16	8.89
Total	180	100

The Anticipated Influence of Artificial Intelligence on Certain Library Services

Table 4 shows the perception of the respondents on the impact of artificial intelligence on library services. The average mean ratings of all questions were between 4.02 and 4.18 indicating a good attitude toward artificial intelligence technologies. The statement "AI improves information retrieval" was ranked best (Mean = 4.18) followed by "AI enhances operational efficiency" (Mean = 4.15) and "AI enhances overall library service quality" (Mean = 4.12). Based on the statistics, most of the respondents seem to agree that Artificial Intelligence may significantly improve the library services, particularly in information retrieval, operational efficiency and service quality.

Table 4. Mean Score Analysis of AI Impact on Library Services Likert Scale 1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Statement	Mean	Std. Deviation
AI improves information retrieval	4.18	0.76
AI enhances user assistance services	4.02	0.81
AI improves cataloguing and indexing	4.10	0.72
AI increases operational efficiency	4.15	0.79
AI improves overall library service quality	4.12	0.75

Where

N = 180 respondents.

A Relationship Between the Use of AI and the Efficiency of Services

The findings of the correlation analysis between the implementation of AI and the effectiveness of service are shown in Table 5. The correlation coefficient between the use of artificial intelligence and service efficiency is 0.68, which suggests that the two variables are positively correlated at the statistical level. The results of this study indicate that the higher the use of artificial intelligence technology in libraries, the higher the efficiency of library services. In this regard, there is no question that artificial intelligence technology may improve the functioning of libraries by ensuring faster access to information, automation and better service delivery.

Table 5. Correlation Analysis AI Use and Service Efficiency Relationship

Variables	AI Usage	Service Efficiency
AI Usage	1	0.68
Service Efficiency	0.68	1

Interpretation: r = 0.68; This indicates strong positive correlation.

The Impact of Artificial Intelligence on Information Retrieval

The findings of the regression analysis investigating the impact that the deployment of AI has on the efficiency of information retrieval are given in Table 6. Regression results indicated that AI accounted for 43.5% of the variance in information retrieval efficiency (R2 = 0.435). The significance value is 0.000 and hence it may be inferred the relationship is statistically significant. The findings of the study contribute to the body of evidence showing artificial intelligence (AI) technologies are essential for enhancing the efficiency and speed of information retrieval systems in libraries.

Table 6. Regression Analysis (AI → Information Retrieval)

Model	R	R^2	Adjusted R^2	Std Error	Sig
AI Usage → Information Retrieval	0.66	0.435	0.431	0.62	0.000

Interpretation: AI explains 43.5% of variance in information retrieval efficiency.

The Impact of Artificial Intelligence on the Satisfaction of Users

Table 7 presents the results of the regression analysis that was conducted to investigate the influence that the deployment of AI has on the satisfaction of customers. The results of the study indicate that the

utilization of artificial intelligence (AI) has a significant impact on the happiness of users ($\beta = 0.61$, $p < 0.05$). An indication of this is that customers consider services offered by artificial intelligence to be advantageous for boosting their overall library experience. Services that are powered by artificial intelligence, such as intelligent search algorithms, automatic suggestions, and virtual help, increase user engagement and satisfaction.

Table 7. Regression (AI → User Satisfaction)

Predictor	Beta	t-value	Sig
AI Usage	0.61	10.02	0.000

Interpretation: AI significantly improves user satisfaction.

The Influence of Artificial Intelligence on Library Automation

Based on the regression analysis, as demonstrated in Table 8, it is evident that the implementation of artificial intelligence (AI) has a substantial impact on the automation of library services ($\beta = 0.63$, $p < 0.05$). An indication of this is that artificial intelligence technologies assist in automating a number of common library jobs, such as cataloging, indexing, and information retrieval. This results in an increase in operational efficiency and a reduction in the amount of manual work that library staff must perform..

Table 8. Regression (AI → Library Automation)

Predictor	Beta	t-value	Sig
AI Adoption	0.63	10.85	0.000

Interpretation: AI significantly contributes to library automation.

Perception Differences between the Different Respondent Groups

An analysis of variance (ANOVA) test was undertaken to analyze the differences in perceptions of artificial intelligence (AI) between librarians, employees of a library, and external readers. The outcome of this test is reported in Table 9. The data suggests that the significance value (p

= 0.006) is less than 0.05 which means that there is a statistically significant difference of perception across the three groups of respondents. It implies that there are likely to be a variety of views between the librarians, staff and customers on the deployment and consequences of artificial intelligence technology in the provision of library services from the standpoint of the library.

Table 9. ANOVA Test (Group Differences)

Source	Sum of Squares	df	Mean Square	F	Sig
Between Groups	6.32	2	3.16	5.21	0.006
Within Groups	107.42	177	0.61		
Total	113.74	179			

Interpretation: $p = 0.006 < 0.05$; Therefore, significant difference exists between librarians, staff and readers.

CONCLUSION

This study discusses the application of AI in enhancing the services of libraries in Lucknow using data collected from 180 respondents including librarians, library workers and outside patrons. Studies suggest that AI has the ability to improve existing library services significantly. Furthermore, the results indicate that

although library stakeholders are increasingly aware of artificial intelligence (AI) technology, further training and awareness campaigns are necessary to enhance its successful utilization. The move to intelligent information management systems was marked by the advent of AI-powered cataloging tools and search engines as the most popular artificial intelligence technology employed by libraries. Data analysis demonstrates that the AI has a great effect on making library services more effective. The study demonstrated a high positive association between AI usage and service efficiency (correlation coefficient = 0.68). Regression study reveals that AI adoption considerably enhances information retrieval efficiency ($R^2 = 0.435$), user satisfaction ($\beta = 0.61$), and library operations automation ($\beta = 0.63$). According to the ANOVA analysis, the perception of artificial intelligence (AI) technology differs significantly among librarians, library personnel and external readers ($p = 0.006$). This means that various stakeholder groups may have varied experiences with AI-driven services. The findings indicate that AI has the ability to transform traditional libraries into more efficient, automated and accessible data repositories. The purpose of artificial intelligence is to optimize information retrieval, save manual labor, facilitate user communication, and improve the provision of personal information services. To be successful, it requires technical infrastructure, experienced professionals and continual education for library staff.

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