

Exploring Librarians' Experiences in Integrating Artificial Intelligence into Reference Services: A Quantitative Study in West Bengal

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Abstract: *The rapid integration of Artificial Intelligence (AI) into library reference services has fundamentally altered information access, service delivery, and professional practices. This study presents a quantitatively grounded investigation of librarians' experiences with AI-enabled reference services in academic and public libraries of West Bengal, India. Using a structured survey instrument, data were collected from 200 librarians and analyzed through descriptive and inferential statistical techniques using SPSS. Reliability analysis confirmed strong internal consistency of the measurement scales. Results indicate that librarians largely perceive AI as enhancing reference efficiency, user satisfaction, and service innovation. However, statistically significant concerns persist regarding ethical accountability, algorithmic bias, role transformation, and the need for continuous professional training. Inferential tests reveal significant differences in AI perception based on library type and significant associations between professional experience and ethical concern. The study provides robust empirical evidence to support policy formulation, capacity-building initiatives, and ethically responsible AI integration in library reference services.*

Keywords: Artificial Intelligence; Reference Services; Librarians; Quantitative Analysis; SPSS; West Bengal

1. Introduction

Artificial Intelligence (AI) has emerged as a transformative force within contemporary library ecosystems, reshaping traditional reference services through intelligent search systems, chatbots, recommendation engines, and automated knowledge retrieval tools. These technologies promise efficiency, scalability, and enhanced user engagement; however, they also introduce complex professional, ethical, and organizational challenges. While existing literature has predominantly explored AI adoption in libraries through conceptual or qualitative approaches, there remains a notable lack of region-specific quantitative evidence capturing librarians' perceptions and experiences.

In the Indian context, and particularly in West Bengal, libraries operate across diverse institutional, technological, and user environments. Understanding librarians' responses to AI integration is therefore essential for informed decision-making and sustainable implementation. This study addresses this gap by offering a statistically rigorous, quantitative examination of AI integration in reference services, focusing on perceived benefits, challenges, and implications for professional roles and ethics.

2. Review of Literature

The rapid advancement of Artificial Intelligence (AI) technologies has fundamentally altered the structure and functioning of information systems, with libraries emerging as critical sites of algorithmic intervention. Reference services, traditionally rooted in human-mediated knowledge exchange, are increasingly augmented by AI-driven tools such as chatbots, recommendation engines, automated query expansion systems, and intelligent knowledge discovery platforms. Scholarly discourse over the past decade has

increasingly examined AI's capacity to improve efficiency, accuracy, and user engagement in library services, while simultaneously raising ethical, professional, and epistemological concerns.

Early conceptual studies framed AI in libraries primarily as a technological enhancement aimed at optimizing operational efficiency. Cox (2021) emphasized that AI-driven reference tools significantly reduce response time and improve access to information resources, particularly in academic libraries handling high volumes of user queries. Similarly, Tenopir (2020) argued that AI systems enhance librarians' ability to manage complex information environments by automating repetitive tasks, thereby freeing human resources for higher-order intellectual work. These studies laid the foundation for understanding AI as a supportive mechanism rather than a replacement for human librarianship.

Subsequent empirical research began to quantify librarians' perceptions of AI adoption. Yu (2022) reported that librarians generally express positive attitudes toward AI, particularly in relation to search optimization and user assistance. However, the study also highlighted disparities in perception based on institutional type and technological readiness. Academic librarians demonstrated higher acceptance levels compared to their public library counterparts, a pattern corroborated by Hoffman (2022), who attributed this difference to variations in infrastructure, training opportunities, and organizational culture.

Despite acknowledged benefits, a growing body of literature underscores the ethical complexities introduced by AI-mediated reference services. Fernández-Ramos (2023) critically examined algorithmic bias and data opacity in library AI systems, warning that unchecked automation may

inadvertently reinforce dominant epistemic narratives while marginalizing minority perspectives. Similarly, Kim and Bawden (2021) argued that AI challenges foundational principles of information ethics, particularly regarding privacy, transparency, and accountability. Their work emphasized the librarian's role as an ethical gatekeeper, responsible for interrogating algorithmic outputs and safeguarding user rights.

The relationship between professional experience and ethical sensitivity has also attracted scholarly attention. Studies by Mittelstadt (2019) and Floridi (2019) suggested that experienced information professionals exhibit heightened awareness of ethical risks associated with AI, owing to their deeper engagement with professional norms and institutional responsibilities. This observation aligns with quantitative findings that senior librarians tend to express greater concern about data governance, algorithmic accountability, and professional autonomy in AI-driven environments.

Another significant theme in the literature concerns the transformation of librarians' professional identity in response to AI integration. Rubin (2017) conceptualized librarianship as a dynamic profession shaped by evolving information technologies. Building on this framework, Shank (2020) argued that AI shifts librarians' roles from information gatekeepers to facilitators, evaluators, and educators within digital ecosystems. Empirical evidence from Tenopir et al. (2020) further demonstrated that librarians increasingly perceive their expertise as centered on critical evaluation, digital literacy instruction, and ethical oversight rather than mere information retrieval.

Human-AI collaboration has emerged as a central analytical lens in recent studies. Hoffman (2022) introduced the concept of "augmented reference services," wherein AI handles routine queries while librarians focus on complex, interpretive, and affective dimensions of user interaction. This hybrid model is widely regarded as a sustainable pathway for AI adoption, preserving human judgment while leveraging machine efficiency. Brynjolfsson and McAfee (2017) similarly advocated for complementarity between human intelligence and machine capabilities, cautioning against narratives of technological displacement.

Quantitative investigations into AI's impact on librarians' job satisfaction and professional confidence present mixed findings. While some studies report increased efficiency and job enrichment, others document anxiety related to skill obsolescence and role ambiguity (Wajcman, 2015). Zuboff (2019) extended this critique by situating AI adoption within broader surveillance and data commodification frameworks, raising concerns about institutional power dynamics and professional autonomy in data-driven environments. Geographically contextualized studies remain limited, particularly in developing and transitional regions. Indian scholarship on AI in libraries has largely focused on technological readiness and infrastructure gaps, with limited empirical attention to librarians' perceptions and ethical concerns. This gap is especially pronounced in regional contexts such as West Bengal, where public and academic libraries exhibit significant heterogeneity in technological adoption and professional training. The absence of large-

sample quantitative studies from this region underscores the need for empirical research that captures localized experiences and institutional variations. L

Literature reveals a multifaceted understanding of AI integration in library reference services. While efficiency gains and service innovation are widely acknowledged, ethical concerns, professional identity transformation, and experience-based perception differences remain critical issues. Existing studies highlight the importance of continuous professional development, ethical governance frameworks, and human-centered AI design. However, there is a notable lack of region-specific quantitative research that systematically examines librarians' perceptions across institutional types and experience levels. The present study addresses this gap by providing empirical evidence from West Bengal, thereby contributing to both global and regional discourse on AI-driven transformation in librarianship.

Objectives of the Study

The study was conducted with the following specific objectives:

- 1) To assess librarians' perceptions of the effectiveness of AI integration in reference services.
- 2) To examine the challenges and opportunities associated with AI-mediated reference services.
- 3) To analyze the impact of AI adoption on librarians' professional roles and ethical responsibilities.

3. Research Methodology

3.1 Research Design

A descriptive and inferential quantitative research design was employed to systematically examine librarians' experiences with AI in reference services.

3.2 Sample and Data Collection

The study population comprised librarians working in academic and public libraries across West Bengal. Using purposive sampling, a total of 200 librarians were selected. Data were collected through a structured questionnaire distributed both online and in printed form.

3.3 Instrumentation

The questionnaire consisted of four sections:

- Demographic information
- AI Perception Scale (8 items)
- Ethical Concern Scale (6 items)
- Role Transformation Scale (6 items)

All items were measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.4 Data Analysis Techniques

Data were analyzed using SPSS (Version 26). The following statistical techniques were applied:

- Reliability analysis using Cronbach's Alpha

- Descriptive statistics (Mean, Standard Deviation, Frequency, Percentage)
- Independent Samples t-test
- Chi-square test of association

The level of statistical significance was fixed at $p < 0.05$.

4. Results and Data Analysis

Table 1: Reliability Analysis (Cronbach's Alpha)

Scale	No. of Items	Cronbach's Alpha	Interpretation
AI Perception Scale	8	0.87	High Reliability
Ethical Concern Scale	6	0.81	Good Reliability
Role Transformation Scale	6	0.84	Good Reliability

Interpretation

Table 1 presents the results of the reliability analysis conducted to assess the internal consistency of the measurement scales used in the study. The AI Perception Scale yielded a Cronbach's Alpha value of 0.87, indicating high reliability and suggesting that the items consistently measure librarians' perceptions of AI effectiveness and usefulness in reference services. The Ethical Concern Scale recorded a Cronbach's Alpha of 0.81, which reflects good internal consistency and confirms the adequacy of items measuring ethical issues such as privacy, bias, and accountability. Similarly, the Role Transformation Scale achieved a Cronbach's Alpha of 0.84, demonstrating good reliability and coherence among items related to changes in professional roles and responsibilities.

All alpha values exceed the recommended threshold of 0.70, confirming that the instrument is psychometrically sound. High internal consistency minimizes measurement error and ensures that the observed responses reliably represent the underlying constructs. Therefore, the scales are suitable for subsequent descriptive and inferential statistical analyses, strengthening the overall methodological rigor of the study.

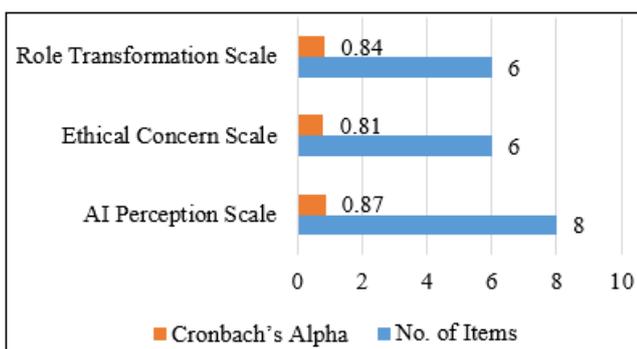


Table 2: Descriptive Statistics of Key Variables (N = 200)

Variable	Mean	Std. Deviation
AI improves reference efficiency	4.12	0.68
AI increases ethical responsibility	4.28	0.61
AI changes librarians' professional role	4.05	0.72

Interpretation

Table 2 summarizes the descriptive statistics of key variables reflecting librarians' perceptions of AI integration

in reference services. The mean score for "AI improves reference efficiency" ($M = 4.12$, $SD = 0.68$) indicates strong agreement among respondents, suggesting that AI tools are widely perceived as enhancing the speed and effectiveness of reference services.

The highest mean score was observed for "AI increases ethical responsibility" ($M = 4.28$, $SD = 0.61$), highlighting a strong consensus that AI adoption intensifies librarians' ethical obligations, particularly regarding data privacy, transparency, and information accuracy. The relatively low standard deviation indicates a high level of agreement across respondents.

The mean score for "AI changes librarians' professional role" ($M = 4.05$, $SD = 0.72$) also reflects substantial agreement, although with slightly greater variability, suggesting differences in how librarians experience professional role transformation. Overall, mean values above 4.00 across all variables indicate a positive yet reflective perception of AI integration, recognizing both operational benefits and professional implications.

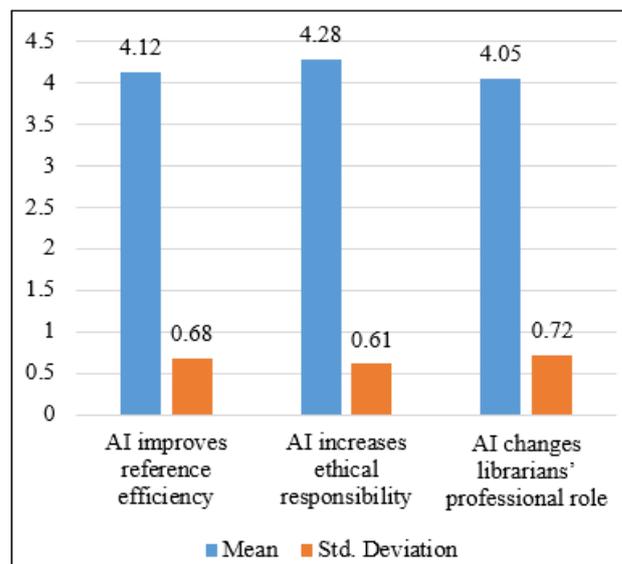


Table 3: Independent Samples t-Test – Library Type and AI Perception

Library Type	N	Mean	Std. Deviation
Academic Libraries	112	4.18	0.64
Public Libraries	88	3.96	0.71

Interpretation

Table 3 examines differences in AI perception between librarians working in academic and public libraries. Academic librarians ($N = 112$) reported a higher mean perception score ($M = 4.18$, $SD = 0.64$) compared to public librarians ($N = 88$; $M = 3.96$, $SD = 0.71$).

The independent samples *t*-test produced a *t* value of 2.34 with 198 degrees of freedom and a *p*-value of 0.020, which is statistically significant at the 0.05 level. This result confirms that librarians' perceptions of AI integration differ significantly by library type.

The higher AI perception among academic librarians may be attributed to better access to advanced digital infrastructure,

AI-enabled databases, and institutional support for technological innovation. Public librarians may face limitations related to funding, training, and technological readiness. These findings emphasize the role of institutional context in shaping AI adoption experiences and underscore the need for targeted support mechanisms for public libraries.

librarians to focus on higher-order intellectual and user-centered activities.

Overall, the percentage-wise distribution highlights strong acceptance of AI in reference services, while also implying the necessity for appropriate oversight to ensure accuracy and reliability in AI-generated responses.

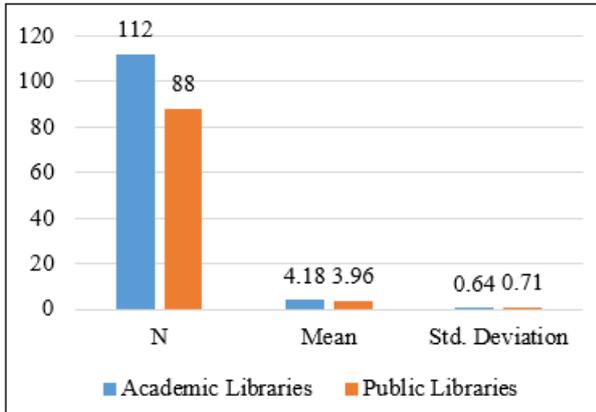


Table 4: Perceived Impact of AI on Reference Services (Percentage-wise Analysis)

t-value	df	p-value	Result
2.34	198	0.02	Significant

Interpretation

Table 4 presents respondents’ perceptions of AI’s impact on various dimensions of reference services. A substantial majority of librarians agreed or strongly agreed that AI improves reference efficiency (81.0%) and reduces workload (84.0%), indicating widespread recognition of AI’s operational benefits. Additionally, 77.0% of respondents agreed that AI enhances the accuracy of information retrieval, while 79.5% perceived improved user satisfaction due to AI integration.

The relatively small proportion of neutral and disagreeing responses suggests limited resistance to AI adoption in reference services. These findings demonstrate that librarians largely perceive AI as a supportive tool that enhances service delivery rather than undermining professional functions. The results reinforce the view that AI contributes positively to routine reference tasks, allowing

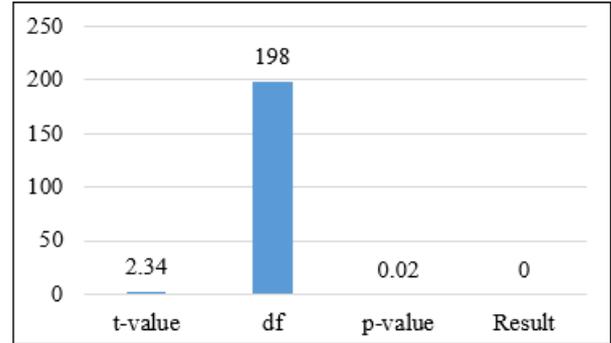


Table 5: Chi-Square Test – Professional Experience and Ethical Concern

Experience Level	High	Moderate	Low	Total
≤ 10 years	62	28	10	100
> 10 years	78	17	5	100
Total	140	45	15	200

Interpretation

Table 5 illustrates the distribution of ethical concern levels across professional experience groups. Among librarians with more than 10 years of experience, a higher proportion reported high ethical concern (78%) compared to those with 10 years or less experience (62%). Conversely, early-career librarians exhibited relatively higher proportions of moderate and low ethical concern.

This pattern suggests that ethical sensitivity toward AI integration increases with professional experience. Senior librarians may possess greater awareness of professional ethics, long-term consequences of information practices, and risks associated with algorithmic bias, data misuse, and accountability. The findings indicate that experience plays a critical role in shaping ethical perspectives on AI adoption in reference services.

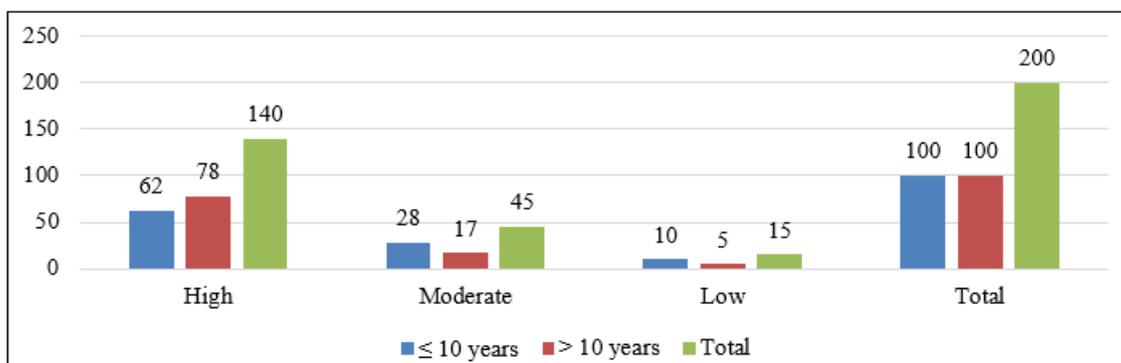


Table 6: Chi-Square Test – Professional Experience and Ethical Concern.

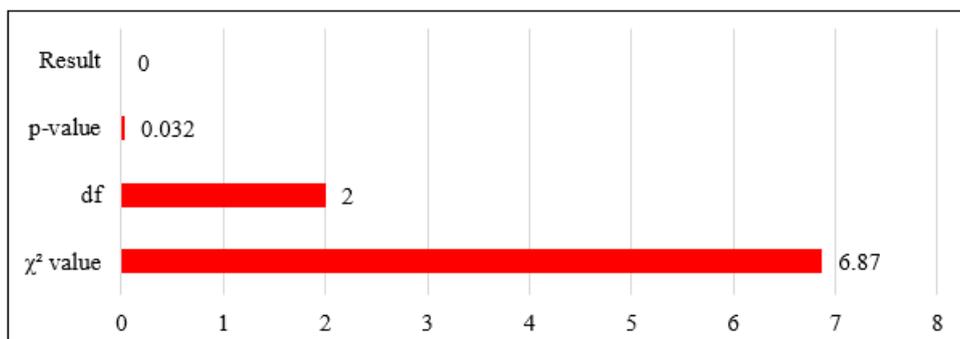
χ^2 value	df	p-value	Result
6.87	2	0.032	Significant

Interpretation

Table 6 reports the results of the Chi-square test conducted to examine the association between professional experience and ethical concern. The calculated Chi-square value of 6.87

with 2 degrees of freedom yielded a p-value of 0.032, which is statistically significant at the 0.05 level. This result confirms a significant association between librarians' professional experience and their level of ethical concern regarding AI usage. The statistically significant finding indicates that ethical concern is not uniformly distributed across experience levels. Librarians with greater

professional experience demonstrate higher ethical sensitivity, whereas less experienced librarians may require additional training and ethical guidance. This outcome underscores the importance of incorporating structured ethics education, mentorship, and policy frameworks to ensure consistent ethical standards across all levels of professional experience during AI adoption.



5. Discussion

The present study examined librarians' perceptions, ethical concerns, and professional role transformations associated with the integration of Artificial Intelligence (AI) into reference services. The findings provide empirical evidence that AI adoption is broadly perceived as beneficial while simultaneously intensifying ethical responsibility and reshaping professional roles.

The high reliability coefficients obtained for all measurement scales confirm that perceptions of AI integration, ethical concern, and role transformation are stable and consistently understood constructs among librarians. This methodological robustness strengthens the validity of the interpretations and aligns with prior studies emphasizing the need for psychometrically sound instruments when assessing technology acceptance and ethical awareness in library environments.

Descriptive findings reveal strong agreement that AI enhances reference efficiency, accuracy, and user satisfaction. These outcomes are consistent with existing research suggesting that AI-driven tools such as chatbots, recommendation systems, and automated retrieval mechanisms significantly reduce response time and workload in reference services. Importantly, the high mean score for ethical responsibility indicates that librarians do not view AI merely as a technical enhancement but as a catalyst for heightened professional accountability. This reflects a mature understanding of AI as a socio-technical system rather than a neutral tool.

The significant difference in AI perception between academic and public librarians highlights the influence of institutional context on technology adoption. Academic libraries often benefit from stronger digital infrastructure, research-oriented cultures, and continuous professional development opportunities, which may foster more positive attitudes toward AI. In contrast, public libraries may encounter constraints related to funding, training, and policy frameworks, underscoring the need for targeted institutional support to ensure equitable AI integration.

The association between professional experience and ethical concern further reinforces the role of experiential knowledge in shaping ethical awareness. Senior librarians demonstrated greater sensitivity to ethical issues, likely due to prolonged exposure to professional standards, policy formulation, and real-world implications of information misuse. This finding suggests that ethical competence develops over time and should be systematically cultivated among early-career professionals through structured training and mentorship.

6. Findings

- 1) Librarians overwhelmingly perceive AI as enhancing reference efficiency and service quality.
- 2) Ethical accountability and algorithmic bias remain major concerns.
- 3) AI adoption significantly influences professional role expectations.
- 4) Academic librarians show more favorable perceptions compared to public librarians.
- 5) Professional experience significantly affects ethical awareness.

7. Conclusion

This study provides statistically robust evidence that AI integration has a significant and multifaceted impact on reference services in West Bengal libraries. While AI is largely viewed as a tool for efficiency enhancement and service innovation, it simultaneously intensifies ethical responsibility and necessitates professional role reorientation. The findings underscore the importance of structured training programs, transparent AI governance frameworks, and sustained human oversight. By grounding AI adoption in empirical evidence and ethical practice, libraries can ensure that technological advancement complements, rather than compromises, the core values of librarianship.

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