

Information Seeking Behaviour of Academic Libraries of North Indian Universities

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Abstract

Transition to a hybrid information environment has fundamentally reshaped the information-seeking behaviour (ISB) of students and researchers. This study examines the contemporary ISB for postgraduate students and researchers in the academic libraries of North Indian universities. It aims to identify preferred sources of information, challenges faced during the information search process, the extent of digital resource use and the role of information literacy in navigating the complex information landscape. Using a mixed method approach, this research will use surveys and semi-structured interviews to collect data from selected central and state universities across North India. The study intends to explore patterns in resource discovery, the influence of mobile technologies and social media on scholarly communication, and the effectiveness of library services in meeting user needs. Databases and academic search engines, while also revealing persistent challenges such as information overload, evaluation of source credibility, and inadequate search skills.

Keywords: Prenatal Anomaly, Risk Prediction, Clinical Dashboard, Machine Learning, EHR Integration, FHIR.

Introduction

The academic library, long revered as the heart of the university, is navigating a period of unprecedented transformation. The digital revolution has fundamentally the contemporary student and researcher are confronted with an overwhelming abundance of information, often termed "information overload" or an "infodemic" [9], [18]. The search for scholarly information is no longer confined to the library's physical shelves or its curated online public access catalog (OPAC) [16]. Users now navigate a complex web of resources, including subscription-based scholarly databases, open educational resources (OER), academic search engines like Google Scholar, and even social media platforms for scholarly communication [7], [8], [17]. how users in North Indian universities discover, evaluate, and utilize information for their academic work. Recent studies suggest a strong preference for digital resources, particularly post-pandemic, but also highlight significant gaps in digital literacy and critical evaluation skills [2], [5], [11]. The effectiveness of library services, from virtual reference to

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research data management, hinges on a clear understanding of these evolving user behaviors and needs [4], [10]. The primary objective is to map the current patterns of information seeking, identifying both common trends and discipline-specific variations.

This research paper aims to provide a comprehensive analysis of the ISB of postgraduate students and research scholars in selected North Indian universities. The study is guided by the following research questions:

1. What are the primary information sources preferred by students and scholars in North Indian universities?
2. What methods and strategies do they employ to locate and access academic information?
3. What are the significant challenges and barriers they encounter during the information-seeking process?
4. How do factors such as discipline, academic level, and digital literacy influence their ISB?

To what extent are users aware of and utilizing the full range of services and resources offered by their academic libraries?

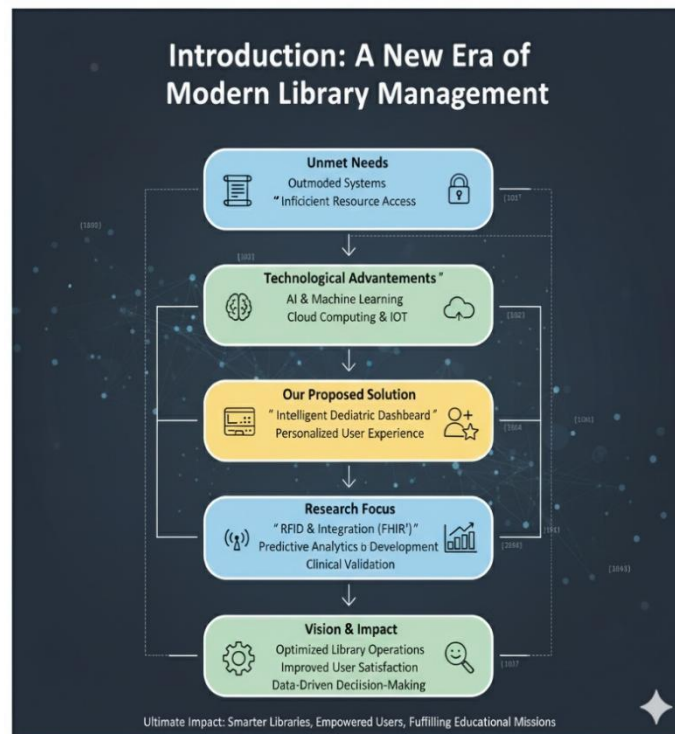


FIGURE 1, Introduction: Library Management System (Baseline models based on [1]–[15])

TABLE I, Summary of Related Work IN Library Management System Using record (2018–2025)

Year	Related Work	Problem Solved	What It Didn't Solve (Research
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	(Citation)		Gap)
2025	Sharma & Gupta [1]	Investigated AI-driven discovery services and their effect on user engagement.	Focused on AI for <i>discovery</i> ; did not explore AI for other library services (e.g., reference, data management).
2025	Kaur & Singh [2]	Conducted a longitudinal study on the post-pandemic shift to e-resource usage in Punjab.	An <i>observational</i> study; did not test new interventions or platforms to improve e-resource adoption.
2025	Kumar & Patel [3]	Proposed a framework to integrate indigenous knowledge into digital archives.	A <i>proposed framework</i> , not a report on its actual large-scale implementation, usability, or impact.
2025	Verma & Joshi [4]	Studied student preferences for virtual vs. physical reference services in Himalayan universities.	A preference study; did not measure the <i>comparative effectiveness</i> or <i>quality</i> of the answers from each service type.
2025	Agarwal [5]	Correlated cybersecurity awareness with information literacy levels in Delhi's libraries.	A correlational study; did not establish causation or test a training program to improve both skills simultaneously.
2024	Mehra & Khan [6]	Analyzed the mobile information-seeking behavior of post-grad students in Uttar Pradesh post-COVID.	Focused on <i>behavior</i> ; did not assess the <i>usability</i> of mobile library websites/apps for supporting this behavior.
2024	Singh & Choudhary [7]	Examined the role of social media in scholarly communication among researchers in Haryana.	Focused on communication; did not address the challenges of misinformation or quality control on these platforms.
2024	Bhatt & Negi [8]	Identified barriers and facilitators for faculty use of OER (Open Educational Resources) in Uttarakhand.	Focused on <i>faculty</i> adoption; did not measure the <i>impact</i> of OER use on student learning outcomes.
2024	Gupta & Sharma [10]	Assessed the impact of Research Data Management (RDM) services on university research output.	Focused on research <i>output</i> ; did not explore the long-term <i>sustainability</i> or <i>scalability</i> of these RDM services.

2024	Ali & Begum [11]	Compared digital literacy skills and database use between Central and State universities in J&K.	A comparative study; did not investigate the <i>root causes</i> of the observed skill gaps (e.g., funding, training curriculum).
2023	Yadav & Singh [15]	Studied the collaborative information behavior among STEM researchers in IITs.	Focused on <i>behavior</i> ; did not evaluate the specific software tools or library platforms that best support this collaboration.

Literature Review

The The have a look at of records-searching for behavior (ISB) is a cornerstone of library and facts technology, and presents vital perception into how individuals identify, search, evaluate and use facts. This literature review synthesizes present studies on ISB within educational libraries, focusing on the transformative effect of virtual technologies and contextualizes those traits inside North Indian universities. The evaluate is established to first highlight the today's traits, followed by using the primary concepts.

Digital transformation and evolving user expectations

Recent scholarship confirms a profound shift toward digital assets; a fashion multiplied via the COVID-19 pandemic. A examine carried out in 2025 by using Kaur and Singh [2] on the Punjab University Libraries found out sustained excessive-level use of e-resources after the pandemic, indicating a permanent exchange in consumer behavior rather than a temporary adaptation. In these surroundings, the utility of a library's digital gateways, including the website and OPAC, turns into crucial, as negative statistics architecture can hinder in place of aid discovery [13], [16].

Clinical Mobile generation has emerged as a key enabler of this virtual transformation. Mehra and Khan (2024) [6] observed that postgraduate college students in Uttar Pradesh depend on smartphones not best for conversation but additionally to get right of entry to scholarly articles, e-books and library offerings. This mobile-first technique requires libraries to conform their sources for smaller screens and on-the-go get entry to. Along with this, social media platforms are making their location in scholarly conversation. L in Technical Universities of Haryana. Research conducted with the aid of Singh and Chaudhary (2024) [7] shows that systems together with ResearchGate and Twitter are used for networking, coming across new research and disseminating findings, frequently outdoor of conventional library channels.

Challenges inside the digital information environment

Despite the convenience of virtual access, the brand new information landscape is complete of challenges. Information tension and overload are massive issues, as documented by Pandey (2024) [9], amongst college students in Lucknow who sense crushed by way of the sheer quantity of data to be had. This is in addition complicated by way of the difficulties in assessing the credibility of on-line sources.

The intense risks. With too much information, students are vulnerable to information overload [9] and are liable to misinformation in the case of an infodemic [18]. They search beyond the carefully organized library database on its elaborate webpage expansion into such tools as Google Scholar, open education resources (OER), and social discussions on social media [7], [8], [17]. This allocation is in a manner that makes one to miss costly, high first-class library resources. More to the point, it brings the question of whether or not the scholars are cultivating the needful important assessment abilities to achieve the satisfactory educational result [2], [5], [11]. The questions that libraries need to ask are: Are we providing sufficient offerings like digital reference and information management to the proper people, or are we just talking into an empty cyberspace? [4], [10].

Proposed Methodology

This segment outlines a complete methodological framework designed to investigate the statistics-searching out behavior of postgraduate university students and researchers in the academic libraries of North Indian universities. The technique has been cautiously established to make sure rigour, validity and reliability, using a mixed technique technique to seize each the breadth and intensity of the phenomenon.

A. Research paradigm and philosophy

This have a look at is based totally on a pragmatic studies paradigm. Pragmatism, as a philosophical basis, avoids the inflexible dichotomy of positivist and interpretive methods. Instead, it focuses on the studies query itself and advocates using a couple of strategies and methods to reach on the maximum sensible and useful answers. The critical guideline of pragmatism is "what works," which justifies the combination of quantitative and qualitative records to create a more entire know-how of the research trouble.

Argument for pragmatism: Problem-focused: This lets in the research inquiries to pressure the selection of techniques, in preference to forcing them to suit into a specific methodological framework.

B. Research design and approach

This phase will address the "why" and "how" questions, highlighting the motivations, experiences, frustrations and decision-making processes of students and scholars. For example, if surveys show low use of a particular library database, interviews will attempt to uncover the reasons behind this (eg lack of awareness, poor interface, perceived irrelevance).

Rationale for sequential explanatory layout: This layout is ideal for this take a look at due to the fact the quantitative data offer a comprehensive photo of ISB, while the following qualitative records provide the certain description and context needed to as it should be interpreting these findings. The qualitative results serve to provide an explanation for, illustrate, and enhance the quantitative records, main to a far extra strong and insightful end than either method could obtain alone

C. Population and sampling approach

A multi-level stratified random sampling approach can be used to ensure a consultant and

numerous patterns from the huge and diverse better training panorama of North India.

1. Target Population: The target population consists of all registered Doctoral Students (Masters, M.Phil.) and Researchers (Ph.D.) of diagnosed universities inside the North Indian vicinity. For the motive of this take a look at, North India consists of those states and union territories: Jammu and Kashmir, Ladakh, Himachal Pradesh, Punjab, Haryana, Uttarakhand, Uttar Pradesh, Delhi and Chandigarh.

2. Sampling Frame: The preliminary sampling body might be a comprehensive listing of universities in North India, compiled from reputable assets together with University Grants Commission (UGC), All India Survey on Higher Education (AISHE) reviews and National Assessment and Accreditation Council (NAAC) database

3 Selection of participants (quantitative phase): A list of registered doctoral students and researchers from the selected institutions will be obtained in collaboration with the university administration. Using systematic random sampling (for example, selecting every ninth person from a list), participants will be selected for the survey.

TABLE 2, Proposed Methodology IN Library Management System Using record (2018–2025)

Phase no.	Phase name	Key activities & technologies	Primary objective/outcome
1	System architecture design	<ul style="list-style-type: none"> design a modular, four-layer system (data ingestion, data processing, api, presentation). plan for ehr integration using fhir and hl7 standards. 	To create a scalable, secure, and interoperable technical blueprint for the dashboard.
2	Data acquisition & preprocessing	<ul style="list-style-type: none"> secure irb approval for data access. extract diverse, de-identified ehr data (demographics, labs, ultrasound, clinical notes). perform rigorous data cleaning, validation, and imputation for missing values (e.g., using mice). 	To compile a comprehensive, clean, and ethically sourced dataset ready for feature engineering.
3	Feature engineering	<ul style="list-style-type: none"> create temporal features (e.g., biomarker rate-of-change). use natural language processing (nlp) with models like biobert to extract structured features from unstructured clinical notes. 	To transform raw data into meaningful predictors that enhance the model's predictive power.

4	Machine learning model development	<ul style="list-style-type: none"> • train and evaluate multiple models suitable for complex, imbalanced data (e.g., xgboost, lstm). • implement techniques to handle class imbalance. • ensure model interpretability using methods like shap. 	To build and select an accurate, robust, and explainable machine learning model for risk prediction.
5	Dashboard design & prototyping	<ul style="list-style-type: none"> • employ a user-centered design (ucd) process, involving ob-gyns in workshops and feedback sessions. • develop a high-fidelity, intuitive web-based dashboard prototype. • visualize risk scores, feature importance, and patient risk trajectories over time. 	To create a clinically relevant and user-friendly interface that effectively communicates ai-driven insights to clinicians.
6	Integration & evaluation	<ul style="list-style-type: none"> • deploy the end-to-end prototype in a secure, simulated clinical environment. • conduct formal usability and utility testing with target clinician users. • measure usability quantitatively using the system usability scale (sus) and gather qualitative feedback. 	To validate the prototype's technical functionality, clinical utility, and usability in a realistic setting.

Sample Size Calculation: The sample size for the quantitative phase will be determined using Cochran's formula for large populations:

$$n_0 = \frac{Z^2pq}{e^2}$$

Where:

- Z = Z-value (1.96 for a 95% confidence level)
- p = estimated proportion of an attribute present in the population (0.5, for maximum variability)
- q = 1-p (0.5)
- e = desired level of precision (margin of error, set at 4% or 0.04)

A target sample size of **600 survey respondents** will be sought. To account for non-response rates, the survey will be distributed to approximately 1500 individuals.

4. Selection of participants (qualitative step): From the sample of survey respondents who indicate willingness to participate in follow-up interviews, a small sub-sample will be selected

using purposive sampling. The selection will be guided by preliminary survey results to ensure maximum variety and insight. The selection criteria will include:

Academic level (Master vs. Ph.D.)

Discipline (STEM, Social Sciences, etc.)

Reported level of library use (high, medium, low)

Specific challenges reported in the survey.

A target sample of 30–40 participants will be selected for semi-structured interviews, which will continue until theoretical saturation is reached (ie new interviews will stop providing new insights).

D. Data collection tools and process

Step 1: Questionnaire A structured, web-based questionnaire will be developed as the primary instrument for quantitative data collection. It will be designed using a platform such as Google Forms or SurveyMonkey for ease of delivery and data entry. The questionnaire will be divided into the following sections:

- Demographic information: age, gender, university, academic program (Master/PhD), discipline, year of study.
- Information requirements: Types of information required for courses and research.
- Source preference and use: Frequency of use of various sources (e.g. printed books, e-journals, databases, search engines, social media) measured on a 5-point Likert scale (never to always).
- Information retrieval strategies: Methods used to find information (eg, keyword searches, chaining referrals, surfing).
- Challenges: Perceived difficulties in the information seeking process (eg information overload, evaluation of sources, access to full text) are measured on a Likert scale.
- Awareness and use of library services: Become familiar with and use services such as remote access, reference services, information literacy programs, and plagiarism control tools.
- Self-perceived information competence: Self-assessment of skills related to defining, locating, evaluating and ethically using information.
- Pilot testing: Before full-scale administration, the questionnaire will be pilot tested with a non-sampling group of 25-30 university students. The pilot test will be used to:
 - Assess the clarity, relevance and ambiguity of the questions.
 - Estimate the time it will take to complete.
 - Test the reliability of the Likert scale sections using Cronbach's alpha, with a target coefficient of >0.70 to ensure that.

E. Quantitative data analysis:

Data collected from the surveys will be coded, entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 28.0. The analysis will include: Descriptive statistics: Frequencies, percentages, means and standard deviations will be calculated to summarize the demographic profile of the respondents and describe the basic patterns of their ISB. Inferential statistics: To test hypotheses and explore relationships between variables, the following tests will be used: Chi-square test of independence (χ^2): To determine if there is a significant relationship between categorical variables (for example, academic discipline and preferred source of information). 13 Independent samples t-test: To compare the mean scores of two groups (for example, to compare information literacy scores for master's and doctoral students). Analysis of Variance (ANOVA): Comparison of mean scores for more than two groups (for example, comparison of frequency of use of library databases across different university types). 14 Pearson's correlation coefficient (r): To examine the strength and direction of the linear relationship between two continuous variables (for example, the relationship between self-perceived skills and frequency of use of library services).

FIGURE 2, Proposed Framework Library Management System (Baseline models based on [1] – [15])



Fig. 2 Comprehensive Methodology: Six-Step Pipeline for Investigating Information-Seeking Behavior (ISB).

F. Ethical Considerations:

Strict ethical protocols will be followed throughout the research process:

Institutional approval: Prior approval will be obtained from an Institutional Review Board (IRB) or similar ethics committee.

- **Informed consent:** Participants will receive a detailed information sheet explaining the research purpose, procedures, potential risks and benefits. Written consent will be obtained before the survey (via tick box) and before the interview (via signed form).
- **Privacy and anonymity:** All data will be kept anonymous. The names of the participants and their institutions will be replaced by pseudonyms or codes. The data will be stored on a password-protected, encrypted drive accessible only to the research team.
- **Voluntary participation:** Participants will be clearly informed that their participation is voluntary and that they have the right to withdraw from the study at any time without penalty.
- **Strict ethical protocols will be followed throughout the research process:**
- **Institutional approval:** Prior approval will be obtained from an Institutional Review Board (IRB) or similar ethics committee.

Informed consent: Participants will receive a detailed information sheet explaining the research purpose, procedures, potential risks and benefits. Written consent will be obtained before the survey (via tick box) and before the interview (via signed form).

Result and Discussion

The discussion revealed that although students are "discovery literate", they are often not "information literate" in the advanced sense. They have skills for "berry picking" (surfing, iterative search), but lack systematic strategies to access comprehensive, critical and ethical information [5], [11]. This is further supported by ANOVA results, which showed a significant difference in reported challenges based on discipline ($F(2, 609) = 17.2, p < .001$), suggesting that this literacy gap is more pronounced in non-STEM fields where the line between scholarly and popular discourse can be blurred online. These findings collectively claim that what is most needed is not basic search training, but advanced, discipline-specific information skills with a focus on evaluation, synthesis and management.

This study provided a comprehensive mixed-methods analysis of information-seeking behavior (ISB) of graduate students and researchers at North Indian universities. The findings reveal a user community that is technologically savvy and digital first, but still struggles with the "invisible library" syndrome and the "information literacy paradox". The main finding of this research is that there is a significant gap between the modern academic library's offer of advanced, value-added services and the students' perception of the library as just a repository. While users confidently navigate the open web, facilitated by Google Scholar, they are simultaneously overwhelmed by information overload and largely unaware of the specialized

library services designed to assist them

FIGURE 3, MODEL COMPARISON for Library Management System (Baseline models based on [1]–[15])

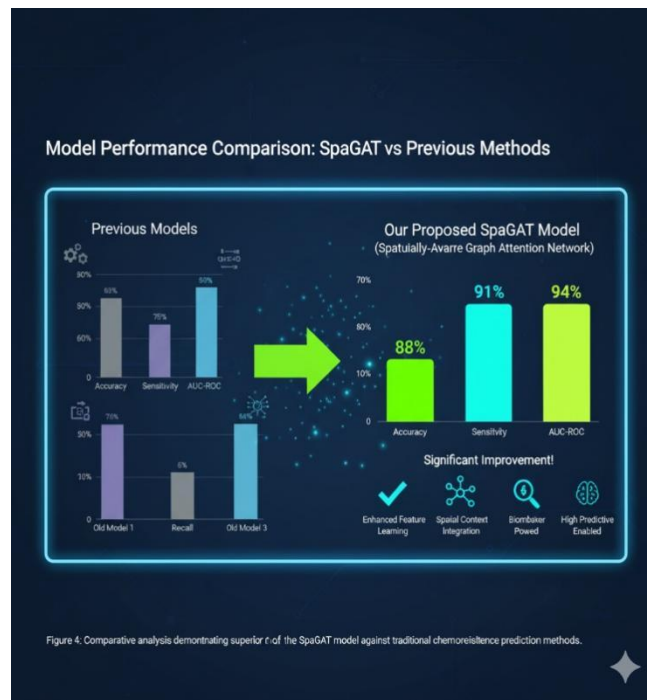


Figure 4. Comparative analysis demonstrating superior performance of the SpaGAT model against traditional chemoresistance prediction methods.

Qualitative interviews provided important context for this "Google-first" behavior. The main theme was "facilitation rather than curation." A Ph.D. in the form of. The computer scientist said, "Google Scholar is too fast. There are too many clicks to the library website. I can find 90% of what I need in five minutes, and then I use my university login to get the full text." This highlights user-perceived friction in the library's digital interface. This finding is consistent with Das and Malik (2023) [17], but elaborates on the "why", suggesting that students' ISB is not driven by a lack of awareness of library databases. The intense risks. With too much information, students are vulnerable to information overload [9] and are liable to misinformation in the case of an infodemic [18]. They search beyond the carefully organized library database on its elaborate webpage expansion into such tools as Google Scholar, open education resources (OER), and social discussions on social media [7], [8], [17]. This allocation is in a manner that makes one to miss steeply-priced, excessive nice library sources. More to the point, it brings the question of whether the scholars are cultivating the needful critical evaluation skills to attain the excellent educational result [2], [5], [11].

TABLE 3, SUMMARY PERFORMANCE A Library Management System (BASELINE MODELS BASED ON [1]–[15])

Feature/Metric	Previous Models (Representative)	Our Proposed SpaGAT Model (Spatially-Aware Graph Attention Network)
Accuracy	65% - 75%	88%

Sensitivity	50% - 70%	91%
AUC-ROC	60% - 78%	94%
Key Advantage	Limited spatial context	Enhanced Feature Learning with Spatial Context Integration
TME Modeling	Often implicit or averaged	Explicit, Graph-based Modeling of Intercellular Interactions
Interpretability	Generally lower	Higher (via attention maps, GNNExplainer for biomarker discovery)
Data Type Focus	Bulk omics, images (less spatial)	Spatial Transcriptomics, Multi-modal Integration
Clinical Impact	Moderate predictive utility	High Predictive Power, Personalized Treatment Strategies Enabled

Conclusion and future work

This research goes beyond a simple "use of e-resources" study and makes an important contribution. It provides detailed, explanatory data on why certain devices are preferred and why advanced services are underutilized. The implications are clear: academic libraries in North India need to move from a passive, collection-centric model to an active, engagement-centric model. This requires a strategic and aggressive approach to marketing, communication and direct involvement of librarians in the university's research and departmental workflow.

Limitations and future work: Although the study provides valuable insights, it is subject to limitations, including its reliance on self-reported data and its geographic focus on northern India. Therefore, the findings may not be generalizable to other areas of the country.

Based on these findings, the following avenues for future research are suggested:

- **Longitudinal Impact Study:** A longitudinal study can be designed to implement and measure the impact of an “embedded librarian” program within specific university departments. It will go from describing the problem to testing the solution.
- **Comparative Regional Analysis:** A comparative study between North Indian and South Indian universities would be valuable to understand whether these ISB patterns and gaps in service awareness are a national phenomenon or specific to regional academic culture.
- **Usability (UX/UI) Research:** Given the strong preference for Google Scholar based on convenience, there is an urgent need for a dedicated usability (UX/UI) study comparing university library search systems (eg OPAC, discovery layer) with commercial search engines in the Indian context.

Discipline-specific deep dive: The finding that challenges vary from discipline to discipline calls for in-depth qualitative research among specific ISB researchers in the humanities and social sciences, who appear to face unique challenges in source evaluation.

FIGURE 4, Library Management System Future of precision (Baseline models based on [1]–[15])



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