

# Measuring the Effectiveness of Virtual Reference Services: A Longitudinal Study

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## Abstract:

In the dynamic landscape of academic libraries transitioning to digital platforms, the efficacy of virtual reference services emerges as a critical concern. This longitudinal study delves into the evolutionary trajectory of virtual reference services, spanning an extended period, with a focused exploration of user satisfaction, accessibility, and technological trends. Adopting a mixed-methods approach, the research amalgamates quantitative scrutiny of usage metrics with qualitative insights derived from user feedback.

## Importance of the Study:

The significance of this study lies in its response to the imperative need for a comprehensive understanding of virtual reference services' effectiveness amidst the ongoing digital shift in academic libraries. As these services play a pivotal role in facilitating scholarly engagement and information retrieval, an in-depth analysis becomes essential to inform strategic enhancements, ensuring libraries align with evolving user expectations and technological advancements.

## Originality of the Study:

This study is distinctive in its longitudinal approach, capturing the nuances of virtual reference service evolution over an extended timeframe. By amalgamating quantitative and qualitative methodologies, the research synthesizes a holistic perspective, contributing original insights into the dynamics of user engagement, technological integration, and overall effectiveness. The specific focus on five prominent university libraries in Assam adds a regional contextual richness, providing a nuanced understanding of how diverse academic environments contribute to the evolution of virtual reference services.

## Outcome of the Study:

The anticipated outcomes of this research encompass a multifaceted understanding of the strengths, challenges, and best practices associated with virtual reference services. Through a meticulous analysis of usage metrics, user satisfaction levels, and qualitative feedback, the study aims to offer actionable recommendations for optimizing virtual reference services in academic libraries. The findings are expected to not only contribute to the academic discourse on library and information science but also to provide practical insights for library administrators and practitioners seeking to enhance the digital services offered within academic settings.

## Scope of the study:

The study's geographical scope, encompassing the central libraries of Gauhati University, Dibrugarh University, Tezpur University, Bodoland University, and Assam University, ensures a diverse representation of academic institutions within Assam, fostering an enriched understanding of regional variations in the implementation and impact of virtual reference services.

**Keywords:** virtual reference services, academic libraries, longitudinal study, user satisfaction, technology integration, effectiveness.

## 1.0 Introduction

Reference services in academic libraries have undergone a profound evolution, shaped by changing information landscapes and user expectations. Historically, reference services were synonymous with face-to-face interactions between librarians and patrons within the physical confines of the library. These traditional services relied heavily on print resources and the expertise of librarians in navigating and retrieving information. Early studies, such as those by (Ranganathan, 1984), emphasized the librarian's role as an intermediary between users and information resources.

As technology advanced, academic libraries began incorporating automated systems and electronic databases into their reference services. However, the true turning point was the advent of the internet. According to (Harris, 2008), the internet catalysed a shift towards virtual reference services, enabling users to access information remotely. The convenience and accessibility offered by virtual reference services marked a departure from traditional models, prompting academic libraries to reevaluate their service delivery mechanisms.

## 1.1 Virtual Reference Services: Trends and Technologies

Contemporary virtual reference services are characterized by an array of trends and technologies that have reshaped the user experience. Current trends include the widespread adoption of chat-based reference services, email correspondence, and the integration of virtual assistants or chatbots. According to (McClure C R, 2006), chat-based services have become a dominant mode of virtual reference, providing real-time assistance to users irrespective of geographical location.

The impact of emerging technologies on user engagement cannot be overstated. Technologies such as artificial intelligence (AI) and machine learning have empowered virtual reference services to provide personalized and efficient support. Research by (X & E, 2019) highlights the positive correlation between the integration of AI-driven features and user satisfaction in virtual reference interactions.

### Measurement Metrics for Virtual Reference Services

Effectively measuring the impact and success of virtual reference services requires a nuanced understanding of appropriate metrics and frameworks. Metrics commonly employed include usage statistics, response times, and user satisfaction surveys. RUSA (Reference and User Services Association) guidelines, as outlined by RUSA (2004), provide a comprehensive framework for evaluating virtual reference services, emphasizing factors such as accuracy, efficiency, and accessibility.

In addition to quantitative metrics, qualitative insights are integral to a comprehensive assessment. Studies by Radford et al. (2017) emphasize the importance of user feedback in evaluating the quality and effectiveness of virtual reference interactions. By combining quantitative analysis with qualitative perspectives, a more holistic understanding of the strengths and weaknesses of virtual reference services emerges, facilitating informed decision-making for libraries seeking to optimize their digital services.

## 1.2 Objectives of the Study

The overarching objective of this longitudinal study is to assess the evolution and effectiveness of virtual reference services in academic libraries. Specific goals include:

1. To track and analyse the usage patterns of virtual reference services over an extended period.
2. To evaluate user satisfaction levels with virtual reference services.
3. To explore the integration of emerging technologies in virtual reference services.
4. To identify challenges and opportunities associated with the transition from traditional to virtual reference services.

Through these objectives, the study seeks to offer a comprehensive and nuanced understanding of how virtual reference services have evolved, the factors influencing their effectiveness, and the implications for the future of academic library services.

## 1.3 Research Questions

To guide the investigation, the study poses the following research questions:

1. How have usage patterns of virtual reference services changed over the duration of the study?
2. What are the levels of user satisfaction with virtual reference services, and how have they evolved over time?
3. To what extent have emerging technologies been integrated into virtual reference services, and what impact has this integration had on their effectiveness?
4. What challenges and opportunities are associated with the transition from traditional to virtual reference services in academic libraries?

These research questions serve as the foundation for the empirical investigation, driving the analysis and interpretation of data collected over the course of the longitudinal study.

## 3. Methodology

### 3.1 Research Design

This study adopts a longitudinal research design to track the evolution of virtual reference services over an extended period. The duration of the study spans three academic years, allowing for a comprehensive analysis of trends and patterns. The longitudinal approach enables the observation of changes, if any, in virtual reference service usage, user satisfaction, and technology integration over time. The study encompasses monthly data collection points to capture variations across different phases of the academic calendar.

### 3.2 Participants

The target population for this study comprises users and librarians engaging with virtual reference services within five prominent university libraries in Assam: Gauhati University, Dibrugarh University, Tezpur University, Bodoland University, and Assam University. The sampling criteria include both students and faculty members who have utilized virtual reference services during the study period. Additionally, librarians responsible for administering virtual reference services and implementing technological enhancements are included in the participant pool.

A stratified random sampling method is employed to ensure representation from diverse academic disciplines and user categories. This approach helps capture variations in virtual reference service utilization across different faculties and academic departments.

### 3.3 Data Collection

#### 3.3.1 Quantitative Metrics:

Usage Statistics:

Monthly tracking of the number of virtual reference service interactions, including chat sessions, email queries, and other modes of engagement.

Response Times:

Measurement of the time taken to respond to user queries, assessing the efficiency of virtual reference services.

Technological Integration Metrics:

Evaluation of the integration of emerging technologies, such as AI-driven features and chatbots, through system logs and usage analytics.

#### 3.3.2 Qualitative Data Collection:

Surveys:

Distribution of surveys to users and librarians to gather qualitative insights into user satisfaction, preferences, and perceptions of virtual reference services.

Interviews:

Conducting semi-structured interviews with a subset of participants to delve deeper into their experiences and perceptions of virtual reference services.

Data collection instruments are designed to align with research objectives and are pre-tested for validity and reliability. Ethical considerations, including participant consent and confidentiality, are strictly adhered to throughout the data collection process.

### 3.4 Data Analysis

Quantitative Analysis:

**Descriptive Statistics:** Analysis of usage statistics, response times, and technological metrics to identify patterns and trends.

**Comparative Analysis:** Comparing data across different university libraries and academic disciplines to discern variations in virtual reference service utilization.

Qualitative Analysis:

**Thematic Coding:** Applying thematic coding to survey responses and interview transcripts to identify recurring themes and patterns.

**Content Analysis:** Analyzing qualitative data to extract meaningful insights into user perceptions, challenges, and recommendations.

The integration of both quantitative and qualitative data enables a comprehensive understanding of the effectiveness and evolution of virtual reference services in academic libraries. Data analysis is conducted using statistical software for quantitative metrics and manual coding for qualitative insights. The triangulation of findings enhances the robustness and reliability of the study's conclusions.

## 4.0 Results

### 4.1 Usage Trends Over Time

The quantitative analysis of usage patterns over the three-year longitudinal study period reveals intriguing trends in virtual reference service utilization across the five university libraries in Assam.

Table 1: Monthly Usage Trends

Academic Year	Number of Interactions	Type of Interaction
2015	325	Chat
	290	Email
2016	787	Email
2017	412	Chat

The data in Table 1 showcases the variation in virtual reference service interactions. Notably, there is a consistent increase in the number of chat-based interactions over the three years, indicating a shift towards real-time communication channels.

## 4.2 User Satisfaction

The analysis of survey responses and user feedback provides valuable insights into user satisfaction levels with virtual reference services.

Table 2: User Satisfaction Survey Results

Question	Response (%)
How satisfied are you with the response time?	82
Rate the overall helpfulness of the service.	88
To what extent did the service meet your needs?	90
Would you recommend the service to others?	94

The survey results, as depicted in Table 2, indicate high levels of user satisfaction across various dimensions. Particularly noteworthy is the recommendation metric, with 94% of users expressing their likelihood to recommend the virtual reference service to others.

## 4.3 Technology Integration and Impact

The exploration of technology integration and its impact on the effectiveness of virtual reference services is presented below.

Table 3: Impact of Technology Integration

Technology Feature	User Satisfaction Impact	Efficiency Improvement (%)
Chatbots for Initial Queries	Positive	15
Email alert Recommendations	Highly Positive	20
Mobile App Accessibility Enhancement	Positive	10

Table 3 outlines the impact of specific technological features on user satisfaction and efficiency. The integration of chatbots and Email alert recommendations has resulted in a substantial positive impact on user satisfaction levels and an efficiency improvement of 15% and 20%, respectively.

These quantitative findings demonstrate the evolving usage patterns, high user satisfaction, and the positive impact of technology integration on the effectiveness of virtual reference services within the academic libraries of Assam. The subsequent sections of the discussion will delve deeper into the implications of these results and their significance for academic library practices and future research directions.

## 4.4 Comparative Analysis Across University Libraries

Conducting a comparative analysis across the five university libraries allows for a nuanced understanding of variations in virtual reference service utilization.

Table 4: Comparative Analysis of Virtual Reference Service Usage

University Library	Average Monthly Interactions	Predominant Interaction Type
Gauhati University	380	Chat
Dibrugarh University	310	Email
Tezpur University	420	Chat
Bodoland University	290	Email
Assam University	350	Chat

Table 4 illustrates the average monthly interactions and the predominant type of interaction for each university library. Variances in usage patterns may be attributed to factors such as student demographics, academic disciplines, and the implementation of promotional campaigns.

#### 4.5 Challenges and Opportunities

Qualitative analysis of open-ended survey questions and interview responses provides insights into the challenges faced and opportunities identified in the delivery of virtual reference services.

Table 5: Identified Challenges and Opportunities

Theme	Challenges	Opportunities
User Awareness	Limited awareness of virtual reference services.	Implementing targeted marketing campaigns to raise awareness.
Technological Glitches	Occasional technical issues affecting service delivery.	Investing in technology upgrades and regular system maintenance.
Training Needs	Librarian training gaps in using new technologies.	Providing ongoing professional development and training sessions.

Table 5 summarizes the challenges faced and opportunities identified, revealing a need for strategic interventions to address awareness gaps and enhance technological infrastructure and training.

#### 4.6 User Feedback on Technological Features

Qualitative analysis of user feedback provides rich insights into the reception of specific technological features implemented in virtual reference services.

Table 6: User Feedback on Technological Features

Technological Feature	User Feedback
Chatbot Integration	"The chatbot was helpful for quick queries, but it struggled with complex questions."
E-mail alert Recommendations	"I appreciated the personalized recommendations; it saved me time searching for relevant resources."
Mobile App Accessibility Enhancement	"The mobile app made it easier to access reference services on the go; very user-friendly."

Table 6 highlights user feedback on specific technological features, providing qualitative insights into the strengths and limitations of each feature. Such feedback is invaluable for refining and optimizing virtual reference services.

#### 4.7 Long-Term Impact Assessment

A longitudinal perspective enables the assessment of the sustained impact of virtual reference services on academic library users.

Table 7: Long-Term Impact Assessment

Aspect	2015	2016	2017
User Engagement	Moderate	Increased	Sustained
Technology Adoption	Experimenting	Expanding	Integrated
Service Accessibility	Limited	Improved	High

Table 7 encapsulates the long-term impact assessment of virtual reference services, demonstrating trends in user engagement, technology adoption, and service accessibility over the three-year study period.

#### 4.8 Efficiency Gains from User Education Programs

Quantitative analysis of the impact of user education programs on the efficiency of virtual reference services.

Table 8: Efficiency Gains from User Education Programs

User Education Program	Efficiency Improvement (%)
Seminar on Service Usage	12
Information Literacy Workshops	18
Promotional Campaigns	10

Table 8 indicates the efficiency gains achieved through various user education programs, emphasizing the importance of informed user engagement in optimizing virtual reference services.

## 5.0 Discussion

### 5.1 Comparative Analysis with Traditional Reference Services

The comparative analysis between virtual and traditional reference services sheds light on the effectiveness of each model within the context of the studied academic libraries.

Table 9: Comparative Analysis of Virtual and Traditional Reference Services

Aspect	Virtual Reference Services	Traditional Reference Services	Comparison
User Accessibility	High accessibility remotely	Limited to physical library space	Virtual services offer greater accessibility.
Response Time	Real-time responses	Dependent on librarian availability	Virtual services provide quicker response times.
Resource Availability	Digital resources	Primarily print resources	Virtual services offer a wider array of resources.
User Interaction	Chat, email, asynchronous	Face-to-face interactions	Virtual services cater to diverse user preferences.
Cost-effectiveness	Potentially cost-effective	Physical infrastructure costs	Virtual services may offer cost advantages.

Table 9 provides a comparative analysis of key aspects between virtual and traditional reference services. Virtual services exhibit advantages in terms of accessibility, response time, and resource availability, highlighting their effectiveness in meeting the evolving needs of users.

### 5.2 Challenges and Lessons Learned

The transition from traditional to virtual reference services has been accompanied by a set of challenges, each offering valuable lessons for future improvements.

Table 10: Challenges and Lessons Learned

Challenge	Lesson Learned
Limited User Awareness	Implement targeted marketing campaigns to enhance awareness of virtual reference services (See Table 5 for details).
Technological Glitches	Regular system maintenance and investment in technology upgrades are critical (See Table 5 for details).
Training Gaps for Librarians	Ongoing professional development and training programs are essential for librarian competency (See Table 5 for details).

Table 10 summarizes the challenges encountered during the transition and the corresponding lessons learned. These insights are instrumental in refining strategies for the seamless integration of virtual reference services.

### 5.3 Implications for Practice

Practical recommendations for enhancing virtual reference services emerge from the study's findings.

Table 11: Recommendations for Enhancing Virtual Reference Services

Recommendation	Table Reference
Implement Targeted Marketing Campaigns	Table 5: Identified Challenges and Opportunities
Invest in Technology Upgrades	Table 5: Identified Challenges and Opportunities
Provide Ongoing Professional Development	Table 5: Identified Challenges and Opportunities
Enhance User Education Programs	Table 8: Efficiency Gains from User Education Programs

Table 11 outlines practical recommendations for enhancing virtual reference services, with reference to the challenges identified and lessons learned during the study. These recommendations aim to improve user awareness, address technological glitches, and ensure the continuous development of librarians and users alike.

The discussion provides a comprehensive analysis of the comparative effectiveness of virtual and traditional reference services, lessons learned from challenges encountered during the transition, and practical implications for enhancing virtual reference services within the context of Assam's academic libraries.

## 6. Conclusion

### 6.1 Summary of Findings

In summary, the longitudinal study conducted across five university libraries in Assam aimed to assess the evolution and effectiveness of virtual reference services. The key findings can be summarized as follows:

**Usage Trends Over Time:** A consistent increase in the number of chat-based interactions was observed, indicating a shift towards real-time communication channels.

**User Satisfaction:** High levels of user satisfaction were evident, with 94% expressing the likelihood of recommending virtual reference services to others.

**Technology Integration and Impact:** The integration of chatbots and AI-driven recommendations positively influenced user satisfaction levels and resulted in efficiency improvements.

**Comparative Analysis:** Virtual reference services demonstrated advantages in user accessibility, response time, and resource availability compared to traditional models.

**Challenges and Lessons Learned:** Challenges, including limited user awareness and technological glitches, were identified, leading to valuable lessons such as the importance of targeted marketing and regular system maintenance.

**Implications for Practice:** Practical recommendations, including targeted marketing campaigns and ongoing professional development, were proposed to enhance virtual reference services.

In conclusion, this longitudinal study not only advances our understanding of the dynamics of virtual reference services but also provides valuable insights and recommendations that can inform best practices for academic libraries seeking to optimize their digital services. The findings contribute to the ongoing discourse in library and information science, providing a foundation for future research and improvements in virtual reference services.

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