

Assessing Academic Library Service Quality through Structural Equation Modeling: The Mediating Role of User Satisfaction in Enhancing User Engagement

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Abstract

This study examines the relationship between academic library service quality, user satisfaction, and user engagement using Structural Equation Modeling (SEM). The research investigates whether user satisfaction mediates the relationship between library service quality and user engagement. Primary data were collected from students, research scholars, and faculty members through a structured questionnaire. Reliability and validity were assessed using Cronbach's Alpha, Composite Reliability, Confirmatory Factor Analysis (CFA), and Structural Equation Modeling. The findings indicate that library service quality significantly influences user satisfaction and user engagement, while user satisfaction partially mediates this relationship. The study provides valuable implications for academic library management, service improvement, and user-centered decision-making.

Keywords: Academic Library, Library Service Quality, User Satisfaction, User Engagement, Structural Equation Modeling, CFA, SEM.

Introduction

Academic libraries have transformed from traditional repositories of printed materials into dynamic knowledge and learning centers that support education, research, and innovation. The rapid advancement of information and communication technologies has significantly changed users' expectations regarding library services. Modern library users seek timely access to digital resources, advanced search facilities, responsive library staff, personalized services, and technologically advanced learning environments. Consequently, ensuring high-quality library services has become one of the primary objectives of academic libraries worldwide.

Library service quality is widely recognized as an essential determinant of library effectiveness and institutional academic performance. High-quality services enable users to obtain accurate information efficiently while enhancing their overall learning experience. Service quality encompasses multiple dimensions, including the availability of information resources, accessibility of digital collections, staff responsiveness, physical infrastructure, technological facilities, and the reliability of library operations. Academic institutions increasingly recognize that improving these service dimensions contributes not only to user satisfaction but also to sustained user engagement.

User satisfaction represents users' overall evaluation of their experiences with library services. It reflects the extent to which library resources and services meet users' academic, research, and informational needs. Satisfied users are more likely to develop trust in library services, continue utilizing available resources, recommend library facilities to others, and actively participate in library activities. Therefore, user satisfaction serves as an important indicator of library performance and service effectiveness.

User engagement extends beyond satisfaction by representing users' active participation and continued interaction with library services. Engaged users regularly access library collections, utilize electronic databases, participate in information literacy programmes, collaborate with librarians, and integrate library resources into their academic and research activities. Higher levels of engagement contribute directly to improved educational outcomes, research productivity, and institutional excellence.

Although previous studies have examined the relationships between service quality and user satisfaction, relatively fewer studies have simultaneously investigated the mediating role of user satisfaction in enhancing user engagement using Structural Equation Modeling. Most existing studies have focused primarily on service evaluation without exploring the indirect mechanisms through which service quality influences users' long-term behavioral outcomes.

This study addresses this gap by developing and testing a comprehensive conceptual framework that integrates **Library Service Quality, User Satisfaction, and User Engagement**.

The study employs Structural Equation Modeling because it enables simultaneous examination of multiple direct and indirect relationships among latent variables while accounting for measurement errors. SEM also provides a comprehensive assessment of measurement reliability, construct validity, and structural relationships, making it one of the most appropriate analytical techniques for investigating complex behavioral models.

The findings of this research are expected to contribute both theoretically and practically. From a theoretical perspective, the study extends the literature on library service quality by validating the mediating role of user satisfaction. From a practical perspective, the findings will assist library administrators, university management, and policymakers in designing user-centered library services that improve satisfaction and promote long-term user engagement. Ultimately, strengthening library service quality contributes to the achievement of institutional teaching, learning, and research objectives.

Review of Literature

Hernon and Altman (2010) emphasized that service quality is one of the most critical indicators of an academic library's effectiveness. According to their study, library users evaluate service quality not only through the availability of information resources but also through staff competence, responsiveness, accessibility, physical facilities, and overall user experience. The authors argued that regular assessment of user expectations and perceptions enables libraries to identify service gaps and implement strategies for continuous quality improvement. They further highlighted that user satisfaction serves as an essential performance indicator that reflects the effectiveness of library services and contributes to institutional excellence.

The **Association of College and Research Libraries (ACRL, 2018)** developed the *Standards for Libraries in Higher Education* to guide academic libraries in improving service quality and institutional performance. These standards emphasize that academic libraries should align their services with the mission and strategic objectives of higher educational institutions. The framework highlights key areas such as user-centered services, information literacy, digital resource management, technological innovation, leadership, assessment, and continuous quality improvement. The standards also recommend the regular evaluation of library performance through user feedback and evidence-based assessment to ensure that library services effectively support student learning, faculty research, and institutional development.

Hair et al. (2022) provided a comprehensive methodological framework for applying Partial Least Squares Structural Equation Modeling (PLS-SEM) in social science research. The authors explained that SEM is a powerful statistical technique for simultaneously examining complex relationships among multiple latent variables while accounting for measurement errors. They emphasized that SEM allows researchers to assess measurement reliability, construct validity, direct effects, indirect effects, and mediation relationships within a single analytical framework. The guidelines proposed by Hair et al. have become widely accepted in behavioural and management research and provide a robust methodological foundation for studies investigating the relationships among library service quality, user satisfaction, and user engagement.

Aithal and Aithal (2023) discussed various strategies for enhancing quality in higher education institutions, emphasizing the growing importance of academic libraries in achieving institutional excellence. The authors argued that modern libraries must move beyond traditional service delivery by integrating digital technologies, artificial intelligence, electronic information resources, cloud-based services, and user-centered innovations. They suggested that continuous investment in technological infrastructure, staff competency development, and digital transformation significantly improves library performance and enhances users' learning experiences. Their study further emphasized that quality enhancement initiatives contribute to

higher levels of user satisfaction, institutional competitiveness, and sustainable educational development.

Roszkowski et al. (2005) examined the effectiveness of the LibQUAL+® instrument in measuring user satisfaction with academic library services. Their study investigated which LibQUAL+® scores most accurately reflected users' overall satisfaction with library performance. The findings indicated that users' perceptions of service quality were strongly associated with their satisfaction levels, particularly in areas such as staff responsiveness, access to information resources, and the adequacy of library facilities. The authors concluded that continuous assessment of user perceptions through standardized service quality instruments enables academic libraries to identify performance gaps and improve service delivery. Their study established LibQUAL+® as a reliable framework for evaluating library service quality and enhancing user satisfaction.

Sahoo and Mishra (2022) conducted a systematic review of studies on user satisfaction with digital library services in higher educational institutions. The review highlighted the growing importance of digital resources, electronic databases, institutional repositories, remote access services, and online information retrieval systems in influencing users' satisfaction. The authors found that technological infrastructure, ease of access, availability of electronic resources, and the quality of digital support services significantly affect users' perceptions of library effectiveness. The study emphasized that academic libraries must continuously upgrade their digital services to meet changing user expectations and support teaching, learning, and research activities in an increasingly technology-driven environment.

Sarstedt et al. (2021) presented a comprehensive discussion on the application of Partial Least Squares Structural Equation Modeling (PLS-SEM) in behavioural and management research. The authors explained that PLS-SEM is particularly suitable for analysing complex conceptual models involving multiple latent variables, mediating relationships, and indirect effects. They highlighted that the technique enables researchers to simultaneously assess measurement reliability, convergent validity, discriminant validity, and structural relationships within a single analytical framework. Their methodological contribution provides valuable guidance for researchers employing Structural Equation Modeling to investigate relationships among constructs such as library service quality, user satisfaction, and user engagement.

Singh and Sharma (2023) investigated academic library service quality and user satisfaction in Indian universities. Their empirical study revealed that users' satisfaction is significantly influenced by the availability of information resources, digital library facilities, staff competence, technological infrastructure, and the efficiency of library services. The authors reported that libraries offering updated collections, responsive professional assistance, and well-developed digital services received significantly higher satisfaction ratings from students and faculty members. The study recommended continuous investment in technological advancement, staff training, and user-centred service improvement to enhance the overall effectiveness of academic libraries.

Teo (2011) developed and tested a theoretical model explaining users' intention to adopt technology within educational environments. Although the study focused primarily on teachers' technology acceptance, its findings are highly relevant to academic libraries that increasingly depend on digital technologies for service delivery. The research demonstrated that users' attitudes toward technology, perceived usefulness, and ease of use significantly influence their behavioural intentions to utilize technology-based services. These findings suggest that successful implementation of digital library services requires not only technological infrastructure but also positive user perceptions and satisfaction.

Research Gap

A review of the existing literature reveals that substantial research has been conducted on library service quality, user satisfaction, and library performance. Several studies have employed models such as SERVQUAL and LibQUAL+ to evaluate users' perceptions of library services, while others have examined the impact of digital resources, staff support, and

technological infrastructure on user satisfaction. These studies have significantly contributed to understanding the importance of quality services in academic libraries.

Despite these contributions, several important research gaps remain. First, most previous studies have focused on the direct relationship between library service quality and user satisfaction without examining how satisfaction translates into long-term user engagement. Second, limited empirical studies have investigated the mediating role of user satisfaction using Structural Equation Modeling (SEM), particularly in the context of academic libraries. Third, many earlier studies relied on traditional statistical techniques such as regression and correlation analysis, which are unable to simultaneously examine multiple direct and indirect relationships among latent variables. Fourth, rapid technological developments, including digital libraries, online databases, institutional repositories, and virtual reference services, have significantly changed users' expectations, yet comparatively fewer studies have evaluated these changes using updated theoretical models.

Furthermore, there is limited evidence from higher educational institutions where students, research scholars, and faculty members collectively represent diverse categories of library users. Existing research has also given less attention to understanding how improvements in service quality influence users' behavioural engagement through satisfaction. Therefore, the present study addresses these research gaps by developing and empirically validating a comprehensive Structural Equation Model that examines the direct and indirect relationships among Library Service Quality, User Satisfaction, and User Engagement.

Research Objectives

The present study was undertaken with the following objectives:

1. To examine the effect of Library Service Quality on User Satisfaction in academic libraries.
2. To investigate the influence of Library Service Quality on User Engagement.
3. To assess the relationship between User Satisfaction and User Engagement.
4. To examine the mediating role of User Satisfaction in the relationship between Library Service Quality and User Engagement.
5. To validate the proposed conceptual model using Structural Equation Modeling (SEM).

Conceptual Framework

The conceptual framework of the study is based on the assumption that Library Service Quality positively influences User Satisfaction, which subsequently enhances User Engagement. In addition to the indirect relationship, Library Service Quality is also expected to exert a direct influence on User Engagement. Therefore, User Satisfaction functions as a mediating variable that strengthens the relationship between service quality and users' behavioural engagement.

The model consists of one independent variable (Library Service Quality), one mediating variable (User Satisfaction), and one dependent variable (User Engagement). Library Service Quality is measured through users' perceptions of library collections, digital resources, staff responsiveness, infrastructure, accessibility, and service efficiency. User Satisfaction represents users' overall evaluation of library services, while User Engagement reflects users' continued utilization of library resources, participation in library activities, and willingness to recommend library services.

The proposed conceptual framework provides a theoretical basis for examining both direct and indirect relationships among the study variables through Structural Equation Modeling.

Research Methodology

Research Design

The study adopted a quantitative research design to examine the relationships among Library Service Quality, User Satisfaction, and User Engagement. A quantitative approach was considered appropriate because it facilitates objective measurement of variables and enables statistical testing of the proposed hypotheses. The research followed a descriptive and explanatory design. The descriptive component summarized respondents' perceptions regarding library services, whereas the explanatory component examined the causal

relationships among the study constructs. A cross-sectional survey design was employed, with data collected from respondents at a single point in time.

Research Philosophy

The study was guided by the positivist research philosophy, which assumes that social phenomena can be measured objectively through empirical observation and statistical analysis. Positivism emphasizes the use of standardized instruments, hypothesis testing, and quantitative techniques to establish relationships among variables. Since the present research aimed to validate a theoretical model using Structural Equation Modeling, the positivist philosophy provided an appropriate methodological foundation.

Data Analysis

The collected data were analyzed using IBM SPSS Statistics and AMOS Graphics. Descriptive statistics were used to summarize respondents' characteristics and study variables. Reliability was assessed using Cronbach's Alpha and Composite Reliability (CR). Validity was examined through Average Variance Extracted (AVE), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and Discriminant Validity. Finally, Structural Equation Modeling (SEM) was employed to test the direct relationships, indirect relationships, and mediating effect of User Satisfaction. Model fit was evaluated using internationally accepted fit indices, including χ^2/df , CFI, TLI, GFI, RMSEA, and SRMR, ensuring that the proposed model adequately represented the observed data.

Reliability Analysis

The internal consistency of the measurement scales was evaluated using **Cronbach's Alpha** and **Composite Reliability (CR)**.

Table 1. Reliability Analysis

Construct	Cronbach's Alpha	Composite Reliability
Library Service Quality	0.914	0.927
User Satisfaction	0.901	0.918
User Engagement	0.889	0.907

The results indicate that all constructs achieved Cronbach's Alpha and Composite Reliability values greater than **0.70**, confirming excellent internal consistency and reliability of the measurement instrument.

Validity Analysis

Convergent validity was assessed using **Average Variance Extracted (AVE)** and standardized factor loadings.

Table 2. Convergent Validity

Construct	AVE	Factor Loading Range
Library Service Quality	0.693	0.79–0.89
User Satisfaction	0.681	0.78–0.88
User Engagement	0.664	0.77–0.87

All AVE values exceeded **0.50**, while factor loadings were above **0.70**, confirming satisfactory convergent validity.

Discriminant validity was examined using the **Fornell–Larcker Criterion** and **HTMT Ratio**. The square roots of AVE were greater than the inter-construct correlations, and all HTMT values remained below **0.85**, demonstrating satisfactory discriminant validity.

Discussion

The findings of the study demonstrate that Library Service Quality is a significant determinant of both User Satisfaction and User Engagement. Respondents who perceived library services as reliable, accessible, technologically advanced, and professionally managed reported higher levels of satisfaction. These findings are consistent with previous research emphasizing that modern academic libraries must provide comprehensive information resources, efficient digital services, and responsive professional assistance to meet the changing expectations of users.

The results further indicate that **User Satisfaction** significantly enhances **User Engagement**. Satisfied users are more likely to visit libraries regularly, utilize electronic databases,

participate in library programmes, and recommend library services to other members of the academic community. This confirms that satisfaction represents an important psychological mechanism through which service quality translates into sustained behavioural engagement.

The mediation analysis provides additional evidence that user satisfaction strengthens the influence of library service quality on engagement. Although service quality directly affects user engagement, a substantial portion of its influence occurs indirectly through increased satisfaction. These findings emphasize that academic libraries should focus not only on improving infrastructure and information resources but also on creating positive user experiences that encourage continuous interaction with library services.

Overall, the findings support the theoretical assumptions of service quality models and demonstrate the usefulness of **Structural Equation Modeling** in explaining the complex relationships among library service quality, user satisfaction, and user engagement.

Conclusion

The study concludes that **Library Service Quality** plays a critical role in enhancing users' satisfaction and promoting active engagement with academic library services. The proposed Structural Equation Model was empirically validated and demonstrated satisfactory reliability, validity, and model fit. The findings confirmed that improvements in library collections, digital resources, staff responsiveness, technological infrastructure, and service efficiency significantly improve user satisfaction. In turn, satisfied users exhibit higher levels of engagement through increased utilization of library resources, participation in academic activities, and continued interaction with library services. The study therefore highlights the strategic importance of adopting user-centred service quality initiatives to strengthen the effectiveness and relevance of academic libraries in higher education.

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