

Analysis of Critical Paths for the Impact of University Library Value Enhancement from a Student Perspective (Postprint)

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Abstract

Purpose/ Significance: Conducting scientific measurement and evaluation of university library services from a student perspective is a crucial approach to clarifying the key pathways for libraries to enhance their value impact, facilitating service optimization, development framework improvement, and overall value enhancement. **Process/ Method:** This study employs structural equation modeling to analyze 985 valid survey responses, constructing a student-oriented university library value impact model centered on the “Context-Effect-Outcome” framework and identifying key influencing factors. **Results/ Conclusion:** It is recommended that university libraries enhance their value impact through four strategic dimensions: strengthening policy guidance to increase service utilization rates; emphasizing the contribution and value of libraries in supporting the “Double First-Class” initiative; researching and developing service systems aligned with user needs; and enhancing service support for the university’s “Double First-Class” construction.

Full Text

Abstract

[Purpose/Significance] Scientific measurement and evaluation of university library services from a student perspective represents a critical approach to clarifying the key pathways for enhancing library value impact. This orientation helps libraries optimize services, improve developmental frameworks, and elevate their intrinsic value. **[Process/Method]** This study analyzed 985 valid survey responses using structural equation modeling to construct a student-oriented value impact model for university libraries centered on the “Situation-Mechanism-Outcome” framework, thereby identifying key influencing factors. **[Results/Conclusions]** We recommend that university libraries enhance their

value impact through four primary strategies: strengthening policy guidance to increase service utilization rates; recognizing the contribution and value of libraries in supporting “Double First-Class” construction; developing service systems aligned with user needs; and enhancing service support for university “Double First-Class” initiatives.

Keywords: university library; library service; library value; user; learning outcome

1 Literature Review

1.1 Single-Indicator Correlation Analysis

Research on university libraries’ impact on student learning outcomes spans nearly six decades. Early studies typically employed relatively small samples to explore correlations between specific library services—such as resource circulation or visit frequency—and student academic performance. While these single-indicator analyses consistently revealed positive associations between library usage and student achievement, their reliance on isolated variables prevented deeper investigation into the underlying mechanisms of influence. Consequently, these studies exhibited limitations in both depth and breadth, though they provided valuable foundations for subsequent research expansion.

1.2 Multi-Indicator Correlation Analysis

Building upon single-indicator research, multi-indicator analyses have broadened the dimensional scope of variables. Researchers expanded library service indicators beyond traditional resource usage to encompass database utilization, reference services, and information literacy education. Similarly, student learning outcomes evolved from narrow academic performance metrics to include competency development, understanding, and satisfaction. These studies demonstrated that richer library services correlate with improved student outcomes. However, the conceptualization of these indicators has not fully aligned with contemporary higher education contexts, and the research methods, while improved, still fail to systematically articulate the internal logic of library impact on student learning outcomes.

1.3 Research Synthesis

Comprehensive review of existing literature reveals that the library profession has actively pursued impact assessment theory and practice, exemplified by influential initiatives such as ACRL’s “Value of Academic Libraries” project. This body of work generally follows a student-outcome-centered approach to evaluating library value. However, previous research predominantly examined direct relationships between library usage and student achievement while neglecting the mediating processes and failing to analyze differential impact intensities across various library services on distinct learning outcome dimensions. This

study addresses these gaps by employing structural equation modeling to assess relationships among indicator variables within the context of contemporary higher education, thereby identifying critical pathways for university libraries to enhance their value impact.

2 Research Methods

2.1 Theoretical Foundation and Model Construction

Scholarly investigations of library-learning outcome relationships typically examine direct associations between specific library services and academic achievement. Some studies incorporate student characteristics to enrich these analyses. However, a logical flaw persists: the mediating processes through which libraries exert influence remain unexplored, including how student perceptions and evaluations formed during service usage subsequently affect learning outcomes.

Drawing upon the Input-Environment-Outcome (I-E-O) model and the Expectation Confirmation Model (ECM), this study adapts these frameworks to examine university library value impact. Following established research on library service evaluation, our model incorporates five key variables: Perceived Total Benefit, Perceived Total Cost, Expectation Confirmation, Satisfaction, and Continuous Use Intention. Perceived Total Benefit represents students' cognitive assessment of library service usefulness, benefits, and assurance across resource services, literacy education, scientific research support, cultural education, and space services. Perceived Total Cost reflects students' authentic perceptions of time, effort, and financial investment required for library use. Expectation Confirmation denotes the discrepancy between pre-use expectations and post-use perceptions. Satisfaction constitutes the affective evaluation formed after service experience, while Continuous Use Intention indicates students' subjective propensity to continue using library services. Student Learning Outcomes encompass comprehensive abilities, general knowledge, and institutional satisfaction, representing objective reflections of capability enhancement through learning activities.

The theoretical model is illustrated in Figure 1.

[Figure 1: see original paper]

2.2 Questionnaire Design and Distribution

The questionnaire comprised three sections: (1) library usage patterns, (2) student learning outcomes, and (3) demographic information. It specifically investigated five dimensions: library usage behaviors, cognitive evaluations formed during use, expectation confirmation levels, satisfaction and continuous use intentions, and learning outcomes. A 5-point Likert scale (1=strongly disagree to 5=strongly agree) measured respondent agreement.

To validate questionnaire rationality and scientific rigor, a pre-test was conducted with 51 master's and doctoral students from the University of Chinese

Academy of Sciences. Following established pre-testing guidelines, this sample size proved sufficient for detecting item differences. The pre-test yielded a Cronbach's alpha coefficient of 0.951 and KMO value of 0.794, confirming strong reliability and validity for formal deployment.

The formal survey targeted the University of Chinese Academy of Sciences, selected for its comprehensive disciplinary system and rich resources. Based on the institution's 1:33 undergraduate-to-postgraduate ratio and large graduate student population, 1,092 questionnaires were distributed via Wenjuanxing platform, yielding 985 valid responses.

3 Data Analysis

3.1 Sample Data Skewness and Kurtosis

To determine whether the sample data met normality assumptions for structural equation modeling, skewness and kurtosis values were calculated. Results showed absolute skewness values below 3 and absolute kurtosis values below 8 for all measurement items of Perceived Total Cost, Expectation Confirmation, Perceived Total Benefit, Continuous Use Intention, and Student Learning Outcomes, confirming normal distribution suitability.

3.2 Violation Estimation Test

Prior to model testing, violation estimation was assessed to ensure standardized coefficients did not exceed 0.95 and measurement error variance remained within acceptable ranges. Results indicated standardized coefficients remained below 0.95, with Standard Errors ranging from 0.004 to 0.011 and no negative variance values, confirming no violation estimation issues and permitting overall model fit testing.

3.3 Structural Equation Model Fit Assessment

Overall model fit indices demonstrated excellent fit: $\chi^2/df=511.993/192=2.667$, GFI=0.955, AGFI=0.940, NFI=0.968, CFI=0.979, RMSEA=0.041. All paths showed significant P-values (<0.001) except those between Perceived Total Cost and Satisfaction, and between Perceived Total Benefit and Continuous Use Intention. These results indicate an ideal model requiring no modification.

Table 1 presents reliability and validity results for all scale variables.

Squared multiple correlations revealed that latent variables explained substantial variance in their indicators: Perceived Total Benefit explained 60.5% of variance in resource service benefits, 35.4% in space service benefits, 60.8% in literacy education benefits, 41.5% in scientific research service benefits, and 35.1% in cultural education benefits. Perceived Total Cost explained 42.2% of variance in resource service costs, 24.6% in space service costs, 57.4% in literacy

education costs, 35.3% in scientific research service costs, and 31.5% in cultural education costs. These values demonstrate strong explanatory power.

3.4 Path Analysis

3.4.1 Primary Path Relationships Path analysis revealed significant positive relationships among most variables. Perceived Total Benefit significantly influenced Expectation Confirmation, Satisfaction, and Student Learning Outcomes. Perceived Total Cost significantly affected Expectation Confirmation, Continuous Use Intention, and Student Learning Outcomes. Expectation Confirmation positively impacted Satisfaction, while Satisfaction significantly influenced Continuous Use Intention. Continuous Use Intention, in turn, significantly affected Student Learning Outcomes. However, no significant direct effects were found between Perceived Total Cost and Satisfaction, nor between Perceived Total Benefit and Continuous Use Intention.

3.4.2 Key Influencing Factors 3.4.2.1 Situational Factors

Among library services, literacy education services exerted the strongest impact on student learning outcomes, followed by resource services, scientific research services, cultural education services, and space services. This hierarchy underscores the critical importance of literacy education in contemporary higher education environments. While resource services represent the traditional foundation of libraries, their continued evolution and adaptation remain essential. Scientific research services, though slightly less impactful, provide indispensable support for student research activities. Cultural education and space services showed relatively weaker effects, suggesting opportunities for enhancement through improved planning, content development, and management.

3.4.2.2 Mechanism Factors

Comparative analysis of effect sizes identified Perceived Value (comprising Perceived Total Benefit and Perceived Total Cost) and Continuous Use Intention as the most influential mechanism factors, followed by Satisfaction and Expectation Confirmation. Perceived Total Benefit demonstrated a total effect of 0.388 on learning outcomes, while Perceived Total Cost showed a total effect of 0.272 (combining direct and indirect effects through Continuous Use Intention). The combined effect of Perceived Value reached 0.549, with Perceived Total Benefit exerting stronger influence than Perceived Total Cost. These findings confirm that students' cognitive evaluations significantly enhance learning outcomes, with stronger perceptions of value and continuous use intention yielding greater academic benefits.

3.4.2.3 Outcome Factors

Among learning outcome dimensions, general knowledge (including critical thinking, reading comprehension, and writing skills) showed the strongest influence from library services, followed by comprehensive abilities (including research achievements), with institutional satisfaction demonstrating the

weakest effect. This pattern indicates that library services most effectively develop students' foundational knowledge and competencies.

3.4.3 Theoretical Model Revision The revised theoretical model comprises three integrated stages: Situation, Mechanism, and Outcome. In the Situation stage, library services provide the contextual environment that shapes student perceptions. The Mechanism stage involves dynamic interactions among these perceptions: Expectation Confirmation positively influences Perceived Total Benefit, Perceived Total Cost, and Satisfaction; Perceived Total Benefit and Cost directly enhance Satisfaction and Continuous Use Intention. The Outcome stage represents the final impact, where these mechanisms generate improved student learning outcomes. The revised model is presented in Figure 2.

[Figure 2: see original paper]

4 Recommendations

4.1 Strengthen Policy Guidance to Enhance Service Utilization

Persistent discussions about library marginalization reflect that library services have not reached all students, and their core value remains unrecognized. To address this challenge, library decision-makers—university library administrators as key stakeholders—must fundamentally resolve utilization issues through policy guidance that directs management priorities and secures necessary improvements. Policies should explicitly articulate the value of diverse library services in supporting scientific research and talent development, particularly emphasizing libraries' roles as primary participants and facilitators in open science and the fourth research paradigm. By establishing verified facts about libraries' capacity to meet user needs in ubiquitous knowledge environments, policies can help libraries secure strategic positions, demonstrate unique value, and build partnerships rather than mere intermediary relationships, ultimately synchronizing library development with institutional strategic goals.

4.2 Recognize Library Contributions to “Double First-Class” Construction

In the context of open science and data-intensive research paradigms, resources and literacy capabilities are crucial for the entire research process. China's higher education system increasingly emphasizes comprehensive student development. This study empirically demonstrates that library resource services, scientific research support, cultural education, literacy education, and space services all positively impact student learning outcomes and institutional satisfaction. University library administrators must recognize that regardless of developmental stage, maintaining effective user interaction and prioritizing actual user impact represents the foundation for sustainable development. Libraries should integrate their development plans with institutional strategic planning, using student outcomes as the core criterion for service delivery. This alignment

enables libraries to demonstrate their vital role in talent cultivation and scientific research support, thereby proving their indispensable value to stakeholders.

4.3 Develop User-Centered Service Systems

Understanding user information needs and behaviors requires focusing on the cognitive evaluations that library services generate. By assessing actual effectiveness across service dimensions, libraries can construct systems aligned with user needs—a critical path to sustainable development. In the new higher education environment, libraries must adopt diverse service approaches and innovative delivery methods, leveraging new media to enhance user understanding of service types and procedures. This strategy helps overcome traditional stereotypes of libraries as merely study spaces or book repositories, positioning them instead as valuable knowledge service institutions. Libraries should strengthen systematic planning for cultural education and space services, deepen content development, enrich spatial functions, and improve management practices to enhance impact. Simultaneously, libraries must consider disciplinary differences, ensuring equitable resource allocation while prioritizing key development areas and supporting relatively weaker disciplines, thereby providing robust support for all users.

4.4 Enhance “Double First-Class” Service Support

Empirical findings confirm that as a critical situational factor, university libraries influence student learning outcomes by shaping cognitive evaluations that trigger interactions among Expectation Confirmation, Perceived Value, and Continuous Use Intention. While library services demonstrate varying positive impact intensities across different learning outcome dimensions, this study acknowledges limitations in sample scope. Future research should examine more diverse institution types and educational levels to verify whether institutional and student characteristics moderate these relationships. Nonetheless, current evidence strongly supports recommendations for libraries to: (1) actively support institutional development and talent cultivation at the macro level, and (2) align with contemporary trends at the micro level by establishing tiered service systems that accommodate individual differences, integrate disciplinary contexts, and provide comprehensive support for academic publishing, research data management, and intellectual property protection issues that researchers encounter.

5 Conclusion

In an era of rapid information technology development and evolving research paradigms, the ways scientific communities access knowledge have multiplied. Despite persistent challenges including competition from publishers and perceptions of marginalization, this study demonstrates that libraries’ influence on student cognitive evaluations creates statistically significant causal relation-

ships with learning outcomes. Continuous library use proves particularly beneficial for student achievement. By generating compelling empirical evidence of their central role in talent cultivation and scientific research support, libraries can eliminate stakeholder perception gaps, secure their sustainable development foundation, and demonstrate their indispensable campus value. Future research should expand sample diversity and educational stages to further validate and generalize these findings.

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