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## Factors Influencing the Effectiveness of University Library Microservices from a User Perception Perspective: Postprint

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### Abstract

[目的/意义] From the user perspective, this study investigates the effectiveness of university library microservices and identifies factors that exert significant influence on such effectiveness, thereby providing guidance and recommendations for the construction of university library microservices. [方法/过程] Grounded in the Information Systems Success Model and incorporating users' individual cognitive factors, this research constructs a conceptual model of factors influencing university library microservice effectiveness along with corresponding measurement scales, tailored to the distinctive characteristics of university library microservices. An empirical investigation is conducted employing questionnaire surveys and structural equation modeling. [结果/结论] The results demonstrate that: overall, respondents evaluated the effectiveness of university library microservices relatively favorably; however, assessments of micro-content format diversity, micro-knowledge content helpfulness, micro-platform stability, and microservice interactivity were comparatively lower. Microservice quality, micro-content quality, and micro-platform system quality exert direct positive and significant impacts on user satisfaction, with diminishing effect magnitudes in that order. User satisfaction demonstrates a direct positive and significant influence on user benefits; concurrently, micro-content quality, micro-platform system quality, and microservice quality indirectly affect user benefits through the mediating mechanism of user satisfaction. User satisfaction represents the strongest determinant of continuance intention, followed by microservice quality, user benefits, micro-content quality, individual cognition, with micro-platform system quality exhibiting the weakest effect. For users with different identities and usage patterns, significant individual differences are observed in certain variables.

## Full Text

### Preamble

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### Research on Influencing Factors of University Library Micro-Service Effects from the User Perception Perspective

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### Abstract

**[Purpose/Significance]** This study examines university library micro-services from the user perspective and identifies factors that significantly influence micro-service effectiveness, providing guidance for university library micro-service development. **[Method/Process]** Based on the Information Systems Success Model and incorporating user cognitive factors, we constructed a conceptual model and evaluation scale for university library micro-service effectiveness factors, combining the unique characteristics of these services. We conducted an empirical study using questionnaire surveys and structural equation modeling. **[Results/Conclusions]** Findings indicate that users generally evaluate university library micro-services positively, though perceptions of micro-content format diversity, micro-knowledge helpfulness, micro-platform stability, and micro-service interactivity are relatively low. Micro-service quality, micro-content quality, and micro-platform system quality exert direct positive effects on user satisfaction, with influence decreasing in that order. User satisfaction directly and positively affects user benefits, while micro-content quality, micro-platform system quality, and micro-service quality indirectly influence user benefits through the mediating role of user satisfaction. User satisfaction has the greatest impact on continuance intention, followed by micro-service quality, user benefits, micro-content quality, individual cognition, and micro-platform system quality has the smallest effect. For users with different identities and usage patterns, significant individual differences exist in some variables.

**Classification Number:** G250

**Keywords:** University Libraries; Micro-Services; Information System Success Model; User Perception; Individual Cognition

## 1. Introduction

With the rise of micro-information platforms such as Weibo and WeChat, people's information needs, acquisition habits, and utilization methods have undergone profound changes, prompting digital libraries and other information service institutions to extend their services into micro-information environments through mobile devices and social networking platforms. Among 42 first-class

university libraries surveyed as of October 2017, 39 provided micro-services via WeChat, 32 via Weibo, achieving a 92.9% platform adoption rate. However, simply offering micro-services differs substantially from providing services that meet users' refined and personalized information needs, enable them to perceive usefulness, and encourage continued use. Existing research reveals significant variations across libraries in micro-service content, functionality, and platform features.

Previous studies have approached library micro-service evaluation from several angles. Some analyzed usage data from social platforms: R. Garciamilian et al. [1] found a positive correlation between Facebook popularity and tags, photos, events, and posts among 72 academic health sciences libraries, with libraries posting micro-videos attracting more followers. L.A. Vucovich et al. [2] evaluated Facebook usage data from representative blogs and YouTube channels to assess how effectively these social networking tools meet user needs and attract participation. Li Hui [3] categorized and statistically analyzed Weibo content from Chongqing University and Nanjing University libraries, designing an evaluation model based on comprehensive information release and response patterns. Other studies examined micro-service quality or satisfaction from the user perception perspective. H.M. Kim et al. [4] modified four dimensions and two endogenous structures from the E-S-QUAL scale to measure user-perceived service quality of library social media from three functional angles: online information processing, library information services, and social media platforms. Ma Zhuo and Guo Mohan [5] constructed a conceptual model from perceived quality, cost, risk, and usefulness to examine factors influencing continuance intention of digital library micro-services. Cui Jingfeng et al. [6] developed a user satisfaction evaluation scale for library WeChat platforms from five dimensions: sensory acceptance, content attractiveness, task completion, psychological pleasure, and usage benefits.

Overall, existing research has separately examined micro-service quality and effectiveness, with few studies linking quality factors to outcome factors. Effectiveness evaluation perspectives remain relatively narrow, lacking comprehensive exploration from the user viewpoint to identify aspects significantly influencing various effectiveness factors. This limits the ability to prioritize improvements in library micro-service quality and effectiveness. Our study addresses these gaps.

Since W.H. DeLone and E.R. McLean proposed the initial Information Systems Success Model in 1992, the model and its revisions have been widely applied to evaluate various information systems and identify variables affecting system success (such as high usage efficiency and high benefits). Through expanding independent variables and incorporating new mediating variables, the model has been successfully applied in digital library contexts. For instance, M.N. Masrek and J.E. Gaskin [7] incorporated perceived usefulness, perceived ease of use, and cognitive absorption into the model to study factors influencing user satisfaction with academic web digital libraries. Wu Haidong [8] added subjective

norms and self-efficacy to system, information, and service quality to examine factors affecting digital library system usage and performance. Library micro-services are essentially library information systems built on micro-platforms such as WeChat, Weibo, or APP clients. Therefore, this study adopts the Information Systems Success Model as the foundational framework for investigating university library micro-service effectiveness factors, using structural equation modeling to measure their impact.

Bi Qiang et al. [11] identified digital library micro-service characteristics as “two dimensions and five facets”: mobility and sociality as dimensions, and ubiquity, fragmentation, personalization, interactivity, and shareability as facets. This rich service quality connotation necessitates a second-order model. Drawing on the SERVQUAL model commonly used for traditional library service quality evaluation and referencing studies by M.K. Brady and J. Cronin [12], Zhao Yang [13], and Hu Yuan [14] on digital library mobile service quality, we constructed a second-order model for university library micro-service quality comprising three second-order latent variables: interactivity, assurance, and personalization. Compared with SERVQUAL, our model retains the assurance dimension (measuring service professionalism, reliability, and security) but removes reliability and tangibility dimensions—tangibility and reliability in micro-platform contexts actually concern interface design quality and stability, which belong to micro-platform system quality. Empathy is replaced by personalization, which in micro-environments manifests more in customized services and user hotspot provision. We added interactivity as a dimension, representing a key differentiator from traditional services. Users interact with micro-content resources, service staff, and other users, while sociality and shareability mentioned in literature [11] must be realized through interactivity. Thus, interactivity comprises four measurement variables: interaction channels, interaction functions, interaction timeliness, and interaction service attitude.

## 2. Conceptual Model and Research Hypotheses

### 2.1 Research Model and Hypotheses

The 2003 revised Information Systems Success Model by DeLone and McLean primarily examines how system, information, and service factors affect system usage, user satisfaction, and net benefits from the provider perspective. In university library micro-service information systems, these correspond to “micro-platform system quality,” “micro-content quality,” and “micro-service quality.” For the outcome component, we retain “user satisfaction” and modify “use” to “user continuance intention” based on our user perception perspective, while replacing “net benefits” with “user benefits.”

Micro-content quality measurement variables primarily reference studies [15-18], with knowledge and thematic attributes added to examine their effects on user behavior, satisfaction, and perceived benefits. Micro-content knowledge refers to knowledge-based micro-content beyond messages, announcements, and previews

that helps users update knowledge and solve problems. Micro-content thematic attribute refers to continuous or serialized micro-information that addresses fragmentation-induced learning discontinuity.

Micro-platform system quality measurement variables reference studies [19-22], examining how interface design quality, perceived response speed, stability, and resource availability affect micro-service effectiveness. Although library micro-services primarily operate on enterprise micro-media platforms like WeChat and Weibo, response speed and stability differences significantly impact user continuance intention and satisfaction from the user perspective, warranting retention for measurement.

User satisfaction, continuance intention, and user benefits primarily reference studies [8, 23, 24].

Based on the above analysis, this study constructs the conceptual model shown in Figure 1 [Figure 1: see original paper] and proposes 11 hypotheses:

**H1:** Micro-content quality positively affects user continuance intention toward university library micro-services.

**H2:** Micro-platform system quality positively affects user continuance intention toward university library micro-services.

**H3:** Micro-service quality positively affects user continuance intention toward university library micro-services.

**H4:** Individual cognition positively affects user continuance intention toward university library micro-services.

**H5:** Micro-content quality positively affects user satisfaction with university library micro-services.

**H6:** Micro-platform system quality positively affects user satisfaction with university library micro-services.

**H7:** Micro-service quality positively affects user satisfaction with university library micro-services.

**H8:** Individual cognition positively affects user satisfaction with university library micro-services.

**H9:** User satisfaction positively affects user continuance intention toward university library micro-services.

**H10:** User satisfaction positively affects user benefits.

**H11:** User benefits positively affect user continuance intention toward university library micro-services.

## 2.2 Variable Operationalization

All latent and observed variables in Figure 1 must be transformed into questionnaire items. Combining university library micro-service characteristics with reference literature, we designed measurement items and scales as shown in Table 1 .

### 3. Research Design

#### 3.1 Data Collection

After developing the initial questionnaire, we conducted a pilot test with 5 faculty members and 25 undergraduate and graduate students from Nanjing Agricultural University who had used the library's micro-services. Based on feedback, we added concept explanations and refined language, resulting in a final questionnaire comprising three parts: university library micro-service platform usage, Likert five-point scale items for effectiveness factors, and basic user information (gender, age, institution, status, discipline, etc.).

With 39 measurement items, following the statistical rule of at least 10 samples per observed variable [25], we required over 390 valid questionnaires. Since online surveys via platforms like Wenjuanxing poorly target actual micro-service users, we primarily used offline distribution supplemented by online methods at Nanjing Agricultural University, Nanjing University, Sichuan University, Wuhan University, and Peking University. We collected 659 questionnaires, excluding those who had not used library micro-services, completed too quickly, or showed low quality (identical responses), yielding 454 valid questionnaires. Sample characteristics and platform usage patterns appear in Table 2 .

#### 3.2 Data Analysis Methods

First, we used Cronbach's Alpha coefficients to test internal reliability and construct validity (convergent and discriminant) for scale validation. Convergent validity requires: factor loadings between 0.50-0.95, composite reliability (CR) above 0.6, and average variance extracted (AVE) greater than 0.5 [26]. Second, we employed AMOS 21.0 for structural equation modeling parameter estimation and path analysis, testing path coefficient significance. Third, we used independent samples t-tests and one-way ANOVA to examine differences among user groups. Finally, we conducted descriptive statistical analysis to explore micro-service quality, effectiveness, and influencing factors from the user perception perspective.

### 4. Data Analysis

#### 4.1 Reliability and Validity Test

As shown in Table 3, the overall Cronbach's  $\alpha$  was 0.912, indicating high reliability, with all variables exceeding 0.7. Factor loadings, CR, and AVE met standards (Table 3 ), demonstrating excellent convergent validity. For discriminant validity (Table 4 ), all inter-variable correlations were below 0.85, and each variable's AVE square root exceeded its correlations with other variables, confirming good discriminant validity.

## 4.2 Model Fitting and Modification

Using AMOS 21.0 with maximum likelihood estimation, initial model fit showed some indices below standards. We added necessary paths based on modification indices, achieving good fit for the revised model (Table 5).

Table 6 presents standardized path coefficients, which reflect relationship significance. Among the 11 hypotheses, two initial assumptions—continuance intention  $\leftarrow$  micro-platform system quality and user satisfaction  $\leftarrow$  individual cognition—were not supported. After removing these, the final model appears in Figure 2 [Figure 2: see original paper].

## 4.3 Difference Analysis

To examine differences across gender, age, status, monthly usage frequency, and session duration, we conducted independent samples t-tests and one-way ANOVA. Table 7 lists variables showing significant differences.

# 5. Research Discussion and Conclusions

## 5.1 User-Perceived University Library Micro-Service Quality

(1) **Micro-content quality** averaged 3.7, with all items above 3.5. Comprehensibility (item C4) scored highest at 3.95 with the smallest standard deviation, indicating users find micro-content relatively easy to understand. However, format diversity (C2) and knowledge helpfulness (C6) scored lower than other indicators.

(2) **Micro-platform system quality** averaged 3.61. Users rated interface usability (S1) and menu layout (S2) highly (~3.9), but perceived response speed, stability, and resource availability lower, with platform stability (S4) averaging only 3.34, suggesting stability issues trouble some users.

(3) **Micro-service quality** averaged 3.68: interactivity 3.49, assurance 3.90, personalization 3.79. Interactivity received the lowest ratings, particularly “providing channels for user-user interaction” (Se2) at 3.09—the lowest score overall—indicating user interaction channels are a significant weakness. “Real-time problem handling and response” (Se5) also scored low at 3.41. Assurance items scored near 4.0, though “service accuracy and reliability” (Se8) showed slightly higher standard deviation. For personalization, “providing seat reservation, personal information, and proactive reminders” (Se11) received the highest ratings, while “supporting customization of preferred micro-knowledge types” (Se12) scored lower at 3.6.

## 5.2 User-Perceived University Library Micro-Service Effects

Overall effectiveness averaged 3.8: user satisfaction 3.87, continuance intention 3.85, user benefits 3.72. Users generally evaluated micro-services positively. Satisfaction items mostly received 4-point ratings. For continuance intention,

“I will prefer using library micro-services over other methods” (CI2) scored lower at 3.66. For user benefits, “establishing a good learning exchange circle” (UB4) scored lowest at 3.29, with most users rating it 3 points and low standard deviation, indicating limited recognition of this benefit.

### 5.3 Influencing Factors of University Library Micro-Service Effects

#### 5.3.1 Factors Influencing User Satisfaction

At the  $P < 0.001$  significance level, H5, H6, and H7 were all supported. Micro-content quality, micro-platform system quality, and micro-service quality significantly and positively affect user satisfaction. H7 showed the largest path coefficient (0.26), indicating interactivity, assurance, and personalization most strongly impact satisfaction. Micro-content quality ranked second (H5 coefficient: 0.24), while micro-platform system quality had the weakest effect. Individual cognition's effect on satisfaction (H8) was non-significant (coefficient: 0.04,  $P = 0.515$ ).

#### 5.3.2 Factors Influencing User Benefits

User satisfaction directly and positively affects user benefits (H10 coefficient: 0.45,  $P < 0.001$ ), playing a crucial mediating role. Micro-content quality, micro-platform system quality, and micro-service quality indirectly affect user benefits through user satisfaction.

#### 5.3.3 Factors Influencing Continuance Intention

Micro-content quality, micro-service quality, individual cognition, user satisfaction, and user benefits directly and positively affect continuance intention. Additionally, micro-content quality, micro-platform system quality, and micro-service quality indirectly influence continuance intention through user satisfaction and user benefits. Calculating total effects: user satisfaction has the greatest impact (0.332), followed by micro-service quality (0.276), user benefits (0.270), micro-content quality (0.260), individual cognition (0.190), and micro-platform system quality (0.070).

### 5.4 Individual Differences in Micro-Service Effect Factors

(1) **Gender** showed no significant differences across dimensions. **Age** only significantly affected individual cognition, with 17-20-year-olds showing significantly more positive attitudes, confidence, and value identification toward mobile library services than those over 25.

(2) **User status** significantly affected perceptions of micro-content quality, interactivity, personalization, individual cognition, and user benefits. Undergraduates rated these significantly higher than master's students, and higher than faculty in interactivity, service quality, and user benefits. Undergraduates also scored higher than doctoral students and faculty in individual cognition. Master's and doctoral students rated interactivity higher than faculty.

(3) **Monthly usage frequency**: Users accessing services 11-15 times per

month rated micro-content quality significantly higher than those using services fewer than 10 times.

**(4) Session duration:** Users spending 5-10 minutes per session showed significantly higher satisfaction, continuance intention, and user benefits than those spending less than 5 minutes. Users spending 10-15 minutes showed higher continuance intention than those spending 5-10 minutes.

## 6. Research Recommendations

Data analysis reveals that micro-service quality affects user satisfaction and subsequent behavior more than micro-content or micro-platform quality. Therefore, libraries should prioritize service quality improvement.

**For service assurance,** establish and strictly follow micro-service procedures and norms to ensure accuracy, reliability, and security, preventing user distrust from misinformation or privacy breaches.

**For interactivity**—the core differentiator of digital library micro-services—substantial improvement opportunities exist in channels, functions, and timeliness. Beyond ensuring smooth user-staff communication, expand user-user interaction channels by establishing micro-communities and groups to facilitate knowledge sharing among users with common interests. Professional, efficient, and courteous service staff teams are essential for timely online response, designing engaging micro-activities (e.g., essay contests, video competitions), and regularly feeding back usage hotspots.

**For personalization,** current services focus on simple information push and reminders. Micro-knowledge recommendation and customization remain lacking. Future services should analyze user behavior data and conduct thorough user communication to understand personalized needs, integrate micro-resources accordingly, and support customization for similar user groups.

**Micro-content quality** significantly affects satisfaction and continuance intention, indirectly influencing user benefits. Among its measurement variables, thematic attribute, format richness, and knowledge content show high factor loadings (0.80, 0.79, 0.76 respectively), indicating effective improvement pathways. Currently, most libraries focus on announcements and resource recommendations. Knowledge-based, thematic, and targeted micro-content remain insufficient. Libraries should develop layered micro-content strategies: for undergraduates and master's students, promote reading, information, and data literacy topics using diverse formats (text, images, video, audio) with clear inter-content associations to facilitate systematic learning. For doctoral students and faculty, provide research-oriented micro-disciplinary services, using micro-aggregation technologies to collect, classify, and integrate online academic resources, collection resources, and user-contributed resources into micro-knowledge bases for convenient access.

**Micro-platform system quality** shows high factor loadings for stability

(0.849), indicating its substantial impact on satisfaction and continuance intention. Libraries should emphasize platform operational quality, continuously improving technology to enhance stability, response speed, and download speed for optimal user experience.

**Individual cognition**—including attitudes, confidence, and value identification—directly affects usage and continuance intention. Libraries should strengthen micro-service promotion and training to enhance user cognition.

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#### Author Contributions:

Peng Aidong: Research conceptualization, model construction, and manuscript revision.

Xia Lijun: Data collection, data analysis, and initial draft writing.

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**Abstract:** [Purpose/significance] This paper aims to comprehensively discuss the influence factors of effect of university library micro-services from the perspective of user perception, identify the aspects that have significant influence on the effect of micro-services, and provide guidance for the construction of university library micro-services. [Method/process] Based on the characteristics

of university library micro-services, this study constructs the concept model and the related evaluation scale of the influence factors of effect of university library micro-services by extending the information system success model with the factor-personal cognition, and conducts an empirical study by questionnaire survey and structural equation model methods. [Result/conclusion] Study results are as follows: Firstly, as a whole, the users' evaluation of the effect of university library micro-services is relatively high and the evaluation of micro-content form diversity, micro-knowledge help, micro-platform stability and micro-service interaction from user perspective is slightly lower. Secondly, micro-service quality, micro-content quality and micro-platform system quality have a significant positive influence on user satisfaction and the influence of these variables falls in turn; user satisfaction has a significant positive influence on user benefits, and micro-content quality, micro-platform system quality and micro-service quality directly affect user benefits through the intermediary role of user satisfaction; user satisfaction has the greatest impact on the intention of continuous use, followed by micro-service quality, user benefits, micro-content quality, personal cognition and micro-platform system quality. Thirdly, owing to users' different identities and use conditions, there are significant individual differences in some variables.

**Keywords:** university libraries; micro-services; information system success model; user perception; personal cognition

*Note: Figure translations are in progress. See original paper for figures.*

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