

Research on the Construction of a Mobile Library Service Quality Optimization Model: Postprint

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Abstract

[Purpose/Significance] Given the complexity of factors involved in optimization endeavors, constructing an appropriate optimization model for mobile library service quality can effectively guide optimization practices. [Method/Process] Through questionnaire surveys, this study empirically analyzes the influencing relationships among service quality, user satisfaction, and users' continuous usage intention. The findings reveal that users' cognitive perceptions of service quality and emotional experiences formed during their interaction with the mobile library platform influence value identification, which subsequently affects user satisfaction and continuous usage intention. [Results/Conclusion] Based on the empirical analysis results, a "flight" model for mobile library service quality optimization is constructed, which is demand-driven, leverages the principal role of service quality in enhancing user satisfaction and promoting continuous usage, and assists users in expanding their service quality cognition and strengthening emotional connections through training and promotion.

Full Text

A Study on Constructing the D?Squat Model to Optimize the Service Quality of Mobile Library

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Abstract

[Purpose/Significance] Given the complexity of factors involved in optimization efforts, constructing an appropriate mobile library service quality optimization model can effectively guide optimization practices. **[Method/Process]** Through questionnaire surveys, this study empirically analyzes the relationships among service quality, user satisfaction, and users' continued usage intention. The findings reveal that users' cognitive and emotional experiences of service quality formed during their interaction with mobile library platforms influence value identification, which in turn affects user satisfaction and continued usage intention. **[Result/Conclusion]** Based on these empirical results, this paper constructs a "Flight" model for mobile library service quality optimization, which is led by user demands and leverages service quality as the main driver for enhancing user satisfaction and promoting continued usage, while training and promotion help expand users' service quality cognition and strengthen emotional connections.

Keywords: mobile library; service quality optimization; user satisfaction; continued usage behavior; D?Squat model

1. Introduction

Since 1993, when the University of South Alabama Library first tested accessing library resources via personal digital assistants (PDAs) [1], to 2003 when Beijing Institute of Technology Library launched mobile library services [2], extending library services through mobile devices to lengthen the service value chain [3] has rapidly gained unanimous recognition among libraries worldwide. With the development of mobile internet technology and mobile device forms, library services have evolved from early SMS/MMS [4-5] to WAP pages [6-7], and now to current mainstream models based on APPs [8-9] and WeChat [10-11]. Beyond traditional services such as book inquiry, reservation, and renewal, libraries have injected new ideas into reference consultation [12], subject services [13], and freshman orientation [14] through mobile forms, while exploring new directions in mobile information services such as reading promotion [15], mobile maker spaces [16], and knowledge services [17].

The rapid popularization of mobile services in the library field has spurred extensive research on mobile libraries, with research perspectives shifting from early discussions on implementation technology [18-19] and construction experience [20-21] to deeper analyses of service quality [22-23] and user usage behavior [24-25]. Through systematic reviews of mobile library research [26-27], comparative analyses of domestic and international mobile library development have revealed that domestic library mobile services emphasize construction over management [28], resulting in severe homogenization of platform functions and content. Consequently, mobile libraries have not become mainstream usage habits for users [29] nor have they delivered expected benefits.

To address this issue, researchers have suggested that the development focus

of mobile libraries should shift from device priority back to user priority [30], making service optimization a new research focus. Yin Wenwu [31] analyzed the components of mobile library service quality optimization control from the perspective of information lifecycle theory, while Jin Xiaopu et al. [32] identified interface design, information content, and system performance issues from a user experience perspective and proposed optimization strategies. As most existing optimization strategies are primarily qualitative and lack quantitative evaluation data support for implementation, Shi Guohong et al. [33] integrated the Kano model and IPA matrix to identify and determine the attributes and priority order of mobile library service quality elements. Zheng Dejun and Shen Junwei [34] constructed a perceived quality optimization framework for mobile library service platforms based on the ITIL management framework and proposed mathematical indicators to materialize service optimization efforts. These studies provide evaluation criteria and implementation priorities for mobile library service quality optimization, but existing evaluations mainly focus on service quality and user satisfaction, rarely considering the mechanism of users' continued mobile library usage behavior, let alone analyzing the interactive effects among these three factors.

Given that mobile library service quality optimization involves multiple factors, a scientific service quality optimization model is needed to guide practice. Therefore, this study starts from user demands as the anchor point for service quality optimization, focusing on users' cognition and emotion formed during interaction with mobile library platforms. Based on empirical analysis of the relationships among service quality, user satisfaction, and continued usage, this study constructs a "Flight" model for mobile library service quality optimization, providing a reference framework for optimization efforts.

2. The Anchor of Mobile Library Service Quality Optimization: Focusing on User Demands

User demands are the fundamental basis for mobile library services and an important foundation for service quality optimization. Researchers consistently agree that users' perceived quality of and feedback on library mobile services directly determine construction effectiveness [35]. According to our team's previous empirical research, mobile library service quality attributes oriented toward user demands can be divided into three types [36]: (1) **Functional fulfillment quality**, where the mobile library platform meets user needs through provided service content and functions, enabling users to gain usefulness experiences; (2) **Technical system quality**, which concerns service execution processes and efficiency, reflecting the technical methods through which the mobile library platform fulfills user demands and corresponding to users' usability experiences; and (3) **User care quality**, which represents the psychological experience attributes of user-platform interaction during service delivery. When the mobile library platform enables users to perceive pleasure and personalization during interaction, it can form lasting appeal.

2.1 Functional Demand Expansion

As mobile library services become more popular and user visits increase, new user demands continue to emerge. To improve user satisfaction and promote continued usage behavior, mobile library service providers must not only meet directly expressed user needs but also analyze and predict potential service functions. Therefore, it is necessary to continuously improve the basic service functions of mobile library platforms and leverage new mobile technologies to provide fresh implementation perspectives for traditional library services. For example, the “LibraryQuest” project uses gamified applications to help students familiarize themselves with library collections and services [37]. Location-based navigation services and reservation functions for spatial resources such as library seats can also expand mobile library service content. The Joyner Library at East Carolina University developed a mobile APP called “Research Roadmap” to help researchers discover relevant library resources throughout the entire process from academic conception to research completion.

2.2 System Usability Demand Optimization

A good mobile library platform should not only meet users’ diverse functional needs but also be easy to use [38]. Aesthetically pleasing interface design with clear structure can conveniently and quickly meet user needs while creating pleasant usage experiences, thereby helping attract continued usage. To improve mobile library platform usability, optimization can be controlled from three aspects: page information display, user behavior guidance, and prevention/correction of user errors [39]. For page information display, analyzing factors such as color contrast, shape, and layout for their varying degrees of arousal and stimulation effects [40-41] can enhance page aesthetics and appeal. Meanwhile, considering the capability differences between novice and experienced users, opportunities should be provided for users to rearrange page layouts according to their own priority needs. For user behavior guidance, intuitive navigation, meaningful labels, and quick menus for page switching can provide friendly prompts to promote exploration of new platform functions or services. For user error prevention and correction, corresponding prompts or fault-tolerant mechanisms should be provided when users make input, retrieval, or navigation errors. Additionally, the construction concept of providing different service content for different mobile devices [42] should be changed, promoting universal optimization of mobile library platforms through responsive web design (RWD) [43] to adapt to users’ screen sizes and orientations, thereby solving the problem that users of niche mobile devices cannot enjoy library mobile information services.

2.3 Attention to Interaction Demands

Mobile library platforms have transformed library services from passive waiting to active integration, but widespread platform development does not automatically create user dependence on mobile library services. During service usage, interaction quality significantly impacts user behavior and subsequent actions,

making user interaction with information content, system platforms, and other users essential considerations for mobile library service quality improvement. Regarding service content, researchers propose segmenting user groups to provide differentiated and personalized mobile library services [44], while increasingly more libraries allow users to access and share personal data related to library resource and service usage, becoming an important way to attract user interaction. For user-platform interaction, mobile library platforms must provide interaction entry points and offer timely, effective responses to user feedback and opinions. Integrating with other social network platforms can enable users to share interesting resources and content with others while encouraging user participation in platform construction through suggestions and voting for closing music, thereby elevating interaction levels and achieving co-creation of value between users and mobile libraries.

3. The Driving Force of Mobile Library Service Quality Optimization: Expanding User Cognition

3.1 Analysis of the Relationship Between User Cognition and Continued Usage Behavior

In constructing and applying mobile library service quality evaluation indicators, researchers have found that despite continuous platform function enrichment and system usability improvements, users' enthusiasm for mobile library services remains low, creating a "high praise, low usage" dilemma. Therefore, analyzing the influencing factors and interrelationships of users' continued mobile library usage can enhance usage enthusiasm from a cognitive-behavioral perspective and provide dynamic support for service quality optimization.

Existing studies have analyzed mobile library users' continued usage behavior mechanisms based on theoretical models such as TAM [45], TTF [46], UTAUT [47], ECM-ISC [48], and ISSM [49], with verified influencing factors focusing on internal perspectives like demand satisfaction (e.g., expectation confirmation, usefulness) and cognitive evaluation of mobile library platforms (e.g., ease of use, enjoyment, satisfaction), as well as external perspectives like social factors (social influence) and technical factors (relative advantage). However, contradictory conclusions exist among studies using the same theory. For instance, while Zhao Yang [25] and Chen Minghong [50] verified that "service quality" significantly affects continued usage, Y.M. Huang et al. [49] proposed that "mobile library platform service quality does not significantly affect users' continued usage behavior." Researchers have also integrated these theories, enriching analytical perspectives but creating overlapping factor connotations and expressions, such as UTAUT's "performance expectancy" being similar to TAM's "perceived usefulness."

Since current data on mobile library continued usage behavior primarily comes from questionnaires, similar factor concepts and measurement items can confuse users and affect questionnaire quality. Users' acceptance and continued usage

of mobile libraries align with stimulus-response theory in behavioral psychology: behavioral response tendencies are influenced by stimulus conditions including individual characteristic differences and external environments, with user cognitive evaluation of services serving as a mediating variable between stimulus and response. Therefore, this study uses the classic user behavior model “(Situation) Stimulus-(Organism) Cognition-(Behavior) Response Model (S-O-R Model)”[51] to analyze influencing factors of continued mobile library usage.

Specifically: (1) In the stimulus stage, users assess whether they possess sufficient resources or skills. If users find mobile libraries too effortful, they may discontinue usage. Conversely, as people change personal beliefs, attitudes, and behavioral intentions due to others’ influence, users who perceive widespread usage among peers are more likely to continue. Thus, stimulus conditions affecting user behavioral responses can be observed from self-efficacy [52] and social influence [53] perspectives. (2) Organism cognition includes service quality perception and value perception. From a service quality perspective, users focus on what problems mobile libraries solve, how they solve them, and interaction quality during usage, observable from perceived usefulness (functional quality) [54], perceived ease of use (technical quality) [55], and immersion experience (user care quality) [56]. Value perception indicates users recognize that mobile library platforms can conveniently and quickly meet their needs, forming a value identification mindset observable from perceived value [57]. (3) In the behavioral response stage, when users have positive perceptions of mobile library service value, they demonstrate continued usage intention and behavior, willingness to recommend to potential users, and explore more functions and operations, creating a virtuous cycle. Continued usage intention [58] serves as the observation point for behavioral response.

Based on the seven observation variables analyzed through the S-O-R model and drawing on existing research, this study developed specific measurement scales and conducted a user survey with the Superstar mobile library platform. To ensure data authenticity, the study followed previous researchers’ screening criteria of usage duration exceeding three months [59] and added a frequency condition of more than twice weekly to identify experienced users. Questionnaires with over 80% identical scores or regular patterns were eliminated as invalid, yielding 4,917 valid questionnaires.

Table 1 shows the basic characteristics of respondents, indicating that university faculty and students constitute the main body of experienced mobile library users, with APP clients and WeChat public service platforms being the primary service forms. Since questionnaires were embedded in the mobile library APP client, this platform type significantly outnumbered WeChat public platforms.

The valid questionnaires were randomly split in half, with 2,460 used for exploratory analysis of measurement dimensions, yielding Cronbach’ s Alpha coefficients between 0.73-0.84 and KMO values between 0.75-0.82, indicating good reliability and validity. The remaining 2,457 questionnaires were used for hypothesis model validation, ultimately verifying the path relationships and spe-

cific coefficients among the seven observation variables in Figure 1 [Figure 1: see original paper]. The explained variance of continued usage intention reached 57.2%, demonstrating good explanatory power of the proposed model [60].

The model fit indices in Table 2 all reached recommended values, indicating good fit between the hypothetical model and sample data. Further observation of Figure 1 reveals that the three dimensions of users' mobile library platform service quality perception interact: perceived ease of use (technical quality) influences perceived usefulness (functional quality), and together they influence immersion experience (user care quality). The three service quality dimensions, driven by self-efficacy and social influence, form the main path of "service quality-value identification (perceived value)-continued usage intention" between user cognition and continued usage behavior.

3.2 Strengthening Promotion to Expand User Cognition

Mobile library services feature convenience, personalization, and broad accessibility, freeing users from spatial and temporal constraints and quickly winning favor among young user groups. However, limitations in environment, device screen size, and interaction methods affect user experience to some extent. Researchers have also found that many library homepages lack prominent mobile service identifiers or links, making them difficult for users to discover [61]. Figure 1 shows that social influence can enhance users' perceived usefulness of mobile libraries. Therefore, summarizing and refining mobile library advantages for promotion and publicity can improve the current low awareness [62], enabling more users to experience mobile library service advantages, enhancing acceptance, and forming user trust and continued usage intention.

To effectively conduct promotion, it is first necessary to accept that different user groups perceive service quality differently [63] and adopt different promotional strategies for different groups. Second, promotion frequency should be increased and methods innovated. For example, Nanjing University of Science and Technology introduced mobile libraries through hand-drawn comics [64] to enhance user cognition of service advantages and potential value. During promotion, user choice diversity and platform substitutability should be considered to actively reduce switching costs for users. Appropriate material or spiritual rewards should be provided to long-term users to promote their perception of enjoyment. Libraries should also allocate corresponding human and material resources for dedicated marketing promotion [65] to provide long-term guarantees for promotional work.

4. The Resilience of Mobile Library Service Quality Optimization: Enhancing Emotional Connection

4.1 Analysis of the Relationship Between User Emotion and User Satisfaction

The process of users using mobile library services is both a cognitive and an emotional experience process [66], with user satisfaction ultimately formed under the combined effect of cognition and emotion [67]. As a result variable, user satisfaction is considered an important criterion for evaluating mobile library construction success [68]. Fan Xinrong and Shi Guohong [69] and Liu Xiaofeng et al. [70] primarily verified the impact of service quality from a user cognitive perspective on user satisfaction. However, C. Gronroos [71] believed that service is more or less a subjective experience process, while K. Desai and V. Mahajan [72] pointed out that cognition and emotion jointly affect satisfaction, with emotion even playing a more significant role than cognition. Therefore, researchers have shifted to analyzing the relationship between user emotion and satisfaction, categorizing user emotions into pre-use and post-use emotions [73], positive and negative emotions [74], etc. Liu Luchuan and Sun Kai [75] further discovered that surprise is the most important positive emotion affecting user satisfaction and usage behavior.

Regarding user emotions in mobile library usage, researchers have applied user experience to mobile library service quality evaluation [76]. By analyzing different levels of user experience—such as sensory, cognitive, technical, service, emotional, and value levels [77]—they measure users’ emotional experience levels during mobile library usage and provide optimization strategies based on specific evaluation results [32, 78]. Chen Heyang [79] also highlighted the importance of users’ sensory, cognitive, service, and emotional experiences in mobile library user behavior analysis. Consequently, the role of user emotion in mobile library user behavior intention has gained researchers’ attention, with perceived enjoyment [48] or perceived pleasure [49] used to represent emotion in specific analyses.

Zheng Dejun and Li Meiyu [80] confirmed that pre-use emotion affects (perceived) service quality and post-use emotion, while (perceived) service quality influences user satisfaction through post-use emotion and perceived value. Based on the user satisfaction impact model constructed in [80] and combining the “service quality-value identification (perceived value)-continued usage intention” path reflected in Figure 1, this study revised and developed the cognitive and emotional impact structure on user satisfaction and continued usage intention shown in Figure 2 [Figure 2: see original paper]. Figure 2 indicates that users form cognition (service quality) and emotion (user experience) during interaction with mobile library platforms, with cognition and emotion interacting—service quality influences user emotion during usage, while user emotion affects value identification. Under the combined influence of cognition and emotion, good service quality transforms into higher user satisfaction through value

identification, which is the key factor stimulating continued usage intention [25]. As users continue using mobile libraries, more functions and services are perceived, which in turn promotes user satisfaction improvement.

4.2 Conducting User Training to Enhance Usage Emotion

Analysis of Figure 2 reveals that emotional experience formed during mobile library usage is key to generating user satisfaction and continued usage intention. Figure 1' s impact path shows that self-efficacy directly affects user emotion and also promotes emotional enhancement through perceived ease of use. As the primary method for cultivating user self-efficacy, training is particularly important in self-service mobile library platforms.

Based on B.H. Schmitt's [81] customer experience theory, training activities form user emotional experiences through a "feeling-understanding-attitude formation-usage promotion" process. Users perceive, understand, and comprehend mobile library platform functions and implementation methods through training activities, associate platform functions with their own needs, form the platform' s position and value in their minds, and consequently develop emotional connections with the platform. Since user training not only improves understanding and operational proficiency of platform service functions but also enhances users' emotional connection with the platform, mobile libraries should provide specific, clear tasks and operational steps during training activities, emphasize user behavior guidance, and offer timely praise and rewards. For example, designing a WeChat mini-program implementing call number shelving games [82] can give users a sense of achievement and enjoyment when completing shelving tasks, thereby stimulating their willingness to explore more platform functions.

5. Construction of the "Flight" Model for Mobile Library Service Quality Optimization

By elaborating on the three dimensions of mobile library service quality corresponding to users' functional demands, system usability demands, and interaction demands, and analyzing the mechanism of service quality' s effect on user continued usage intention and satisfaction from a service quality perspective, this study empirically discovered that service quality cognition and emotional experience formed during user-platform interaction play critical roles in improving user satisfaction and increasing continued usage enthusiasm. Based on these empirical findings regarding structural relationships among demands, service quality, user satisfaction, and continued usage intention, this study constructs the "Flight" model for mobile library service quality optimization, shown in Figure 3 [Figure 3: see original paper].

Figure 3 first points out that mobile library service quality optimization must be led by demands. User demands are not only the prerequisite for mobile library construction and development but also the basis for verifying optimization effectiveness. Thus, changes in user demands drive continuous service quality

optimization. Second, based on the empirical analysis results in Figures 1 and 2, the process from service quality to perceived value to user satisfaction and continued usage behavior is a natural progression. Good service quality forms the important foundation for user satisfaction and continued usage behavior, placing service quality in a dominant position in mobile library service quality optimization. This structural relationship can be intuitively summarized as an aircraft's "one body, two wings" structure.

Meanwhile, in mobile library construction and development, conducting training and promotion is both a measure to rapidly increase user groups during initial platform construction and an effective method to elevate users from basic understanding and function usage to discovering deep functions and enhancing usage beliefs. This corresponds to the two stimulus factors of "self-efficacy" and "social influence" that affect user service quality cognition, emotion, and behavioral response, serving as the "booster" for mobile library service quality optimization.

This study analyzes the "body," "two wings," and "booster" of mobile library service quality optimization. Based on the English expressions of the involved factors—D for Demands, S for Satisfaction, Q for service Quality, U for continued Usage behavior, A for Advertising, and T for Training—the model is named the "D?Squat Model." This optimization model is built on empirical evidence of service quality's impact on user satisfaction and continued usage intention, reflecting that mobile library service quality optimization requires both continuous platform improvement and training/promotion to strengthen users' service quality cognition and emotional connection. Only through the joint efforts of these three aspects can high user satisfaction and active continued usage be achieved, truly enabling mobile library services to "take flight" in users' lives, learning, and work.

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Author Contributions

Shen Junwei: paper writing; Zheng Dejun: determination and revision of paper framework.

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

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