Optimization Study of Subject Service Platforms Based on the Kano Model: A Case Study of FULink (Postprint)

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Abstract

[Purpose/Significance] The construction of subject service platforms in major university libraries has currently entered a bottleneck period, while internet-based virtual academic communities continue to develop. Introducing services from virtual academic communities into subject service platforms will improve communication methods among platform users, enhance the efficiency of interactions between users and subject librarians, and facilitate scientific research collaboration among users. [Method/Process] Through web-based research, this study summarizes and categorizes services provided by subject service platforms and virtual academic communities, employs questionnaire survey methodology and the Kano model to classify requirements for web-based academic services, and conducts functional priority analysis. [Results/Conclusion] By integrating services from subject service platforms and virtual academic communities, a total of 26 services were identified and classified into four types: one-dimensional, attractive, must-be, and indifferent. Improvement strategies for the FULink subject service platform are proposed for each category.

Full Text

Preamble

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Research on the Optimization of Subject Service Platforms Based on the Kano Model: A Case Study of the FULink Subject Service Platform

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tual academic communities continue to develop. Introducing services from virtual academic communities into subject service platforms will improve communication methods among platform users, enhance the efficiency of communication between users and subject librarians, and provide a platform for research collaboration among users. [Method/Process] Through network investigation, this study summarized the services provided by subject service platforms and virtual academic communities, employed questionnaire surveys and the Kano model to classify the needs for online academic services, and conducted functional priority analysis. [Result/Conclusion] By integrating the services provided by subject service platforms and virtual academic communities, a total of 26 services were identified and categorized into four types: expected, attractive, must-be, and indifferent. Improvement strategies for the FULink subject service platform were proposed for each category.

Keywords: subject service platform; virtual academic community; Kano model; online academic services **Classification Number:** G252 **DOI:** 10.13266/j.issn.0252-3116.2021.15.012

Since Shanghai Jiao Tong University Library first introduced the LibGuides platform in 2010, numerous university libraries in China have successively launched subject service platform construction, shifting the research focus from subject librarians to service platforms. Subject service platforms have evolved from subject blogs and navigation systems into multifunctional platforms integrating navigation, retrieval, document downloading, and reference consultation functions. However, they have also exposed problems such as inadequate maintenance, untimely updates, and low user satisfaction. Meanwhile, the rise of virtual academic communities on the internet not only meets users' academic needs but also provides more convenient and efficient academic exchange platforms, thereby improving research efficiency—precisely addressing the shortcomings of subject service platforms. This paper investigates major university subject service platforms and popular virtual academic communities, summarizes their services, employs the Kano model to analyze user needs, and proposes recommendations for improving the FULink subject service platform, offering reference for other university libraries.

2 Literature Review

2.1 Research Status of Subject Service Platforms

The concept of subject services originated in 1992 with the "Information Arcade" established by the University of Iowa Library in the United States. Chinese scholar Chu Jingli [1] defined subject services as a new service model and mechanism where subject librarians utilize library and public information resources to serve specific institutions and users, establishing a collaborative, frontline-oriented approach based on research and teaching. In recent years, research hotspots have shifted from embedded subject librarians to subject service platforms.

The essence of subject service platforms lies in providing a communication platform between subject librarians and users, leveraging internet-based virtual environments to deliver services such as library collections, subject resources, and reference consultation [2]. Domestic research on subject service platforms focuses primarily on platform optimization. Zheng Dejun [3] conducted in-depth research on user participation behavior in subject service platforms, explaining the relationship between participation level and satisfaction and proposing targeted strategies to deepen user engagement. Liu Jingliang [4] constructed a subject service platform based on Hadoop 2.0 and HTML5 technologies to achieve automatic resource updates, knowledge discovery and storage, academic exchange space construction, and precision marketing. Zhu Pengwei [5] proposed building subject service platforms under the "Internet+Library" vision, using collection resources as the foundation, streaming media as the core, and introducing community space design concepts to create a three-dimensional, autonomous open learning platform. Yang Hualing [6] previously suggested integrating Social Network Services (SNS) into subject service platforms to improve efficiency, though without conducting in-depth research.

Subject service platforms serve as a bridge between subject librarians and users, a medium for delivering subject services, and an important tool for improving service efficiency. However, current platforms suffer from low utilization rates, inconvenient communication between librarians and users, and user migration to virtual academic communities. These issues necessitate changes to adapt to external environments and evolving user needs.

2.2 Overview of Virtual Academic Communities

Virtual Academic Communities (VAC) have developed through four forms: from virtual academic communities and virtual education communities to virtual learning communities and academic social networks, with increasingly mature technology. Users are no longer simple participants but have become creators and maintainers. M. Mumtazimah [7] posited that academic social networks are websites for researchers to share research activities, techniques, publications, and evaluate academic contributions and other impacts. Zhang Ning [8] argued that academic social networks are more specific and specialized than general social networks, primarily targeting academic institutions and research scholars. Compared with subject service platforms, they place greater emphasis on social functions among users. The development of virtual academic communities combines academia with social interaction, not only meeting users' online communication needs but also providing new platforms for sharing research experiences and achievements, obtaining opinions, and seeking help. Integrating virtual learning communities with subject service platforms will address current issues such as low usage rates and poor communication. No existing research has yet combined virtual academic communities with subject service platforms.

2.3 Overview of the FULink Subject Service Platform

The Fujian Province University Digital Library (FULink) provides services including document delivery, interlibrary loan, union borrowing, mobile FULink, and accompanying CDs across 89 institutions in Fujian Province [9]. From an organizational perspective, the FULink subject service platform represents an innovation—a shared subject service platform based on a regional library consortium. With key university libraries in the alliance as the core and ordinary university libraries as member libraries, it forms a service model covering all libraries in the alliance through a computer management platform. Each member library can form cross-university subject service teams based on first-class disciplines, plateau disciplines, or characteristic disciplines [10].

Compared with traditional subject service platforms, FULink's advantages include: a larger number of participating librarians creating scale effects; member libraries leveraging their disciplinary strengths to complement each other; greater cohesion in regional consortium-based teams; and unrestricted off-campus access without requiring VPN. However, FULink also faces common challenges: large user bases, broad disciplinary coverage, and low utilization rates, necessitating platform optimization and upgrading. Combining virtual academic communities with a regional library alliance-based shared subject service platform offers a new approach for other university libraries constructing subject service platforms.

3 Kano Model Theory and Application in Library and Information Science

The Kano model, proposed by Japanese scholar Noriaki Kano [11] inspired by Herzberg's two-factor theory, is a tool for classifying and prioritizing user needs. Based on the relationship between different quality attributes and user satisfaction, product and service quality attributes are divided into five categories [12]: Must-be Quality (M), Attractive Quality (A), One-dimensional Quality (O), Indifferent Quality (I), and Reverse Quality (R). According to relevant theory, virtual academic community construction should avoid reverse services, minimize indifferent services, continuously improve must-be services, ensure the provision of attractive services, and vigorously develop and promote one-dimensional services.

Since its proposal, the Kano model has attracted domestic scholarly attention and played an important role in library and information science research. Zhao Wenjun [13] applied the Kano model to analyze needs for mobile reading services in university libraries; Zhai Mingming [14] used it to analyze user needs for virtual learning shared spaces and proposed improvement suggestions; Shi Yanru [15] utilized it to propose strategies for improving service quality in children's libraries; Li Mengnan [16] applied it to classify WeChat public account services and study supply priority; Yi Ming [17] used it to divide smart library functions into four dynamic levels; Chen Yijin [18] employed it to classify and prioritize

health information services; Zhao Wenjun [19] combined the Kano model with a satisfaction-importance matrix to determine improvement priorities; and Cai Pei [20] used it to categorize research support services. In summary, the Kano model has been fully utilized in various library and information services but has seen limited application in university library subject service platform construction.

4 Empirical Research

4.1 Exploration of Subject Service Platform Functions

Through network investigation of "985" university library websites in China, 17 subject service platforms were identified, with 10 using the LibGuides platform (58.8%). However, 4 platform links were invalid or empty. Some universities also provided other commercial platforms such as Weidu, VIP, and Subject+.

The investigation revealed that LibGuides platforms had relatively 单一 functions, primarily providing navigation services. The Weidu information management platform offered more diverse services, but due to uniform templates, differences between various university platforms were minimal. In contrast, FULink's advantage lies in seamless integration with database resources, while Weidu and LibGuides resource retrieval is limited to in-site searches.

4.2 Exploration of Virtual Academic Community Functions

Through network investigation of popular virtual academic communities at home and abroad, services were summarized in Table 2 . The comparison shows that virtual academic communities emphasize user communication based on SNS and Bulletin Board Systems (BBS), offering features like "group communication," "thematic discussion," "sharing research," "research collaboration," and "research positions"—services currently unavailable in university subject service platforms.

4.3 Feasibility of Integrating Virtual Academic Communities and Subject Service Platforms

The feasibility of integration is high for three reasons. First, both are functionally similar, providing information retrieval, document delivery, and online communication, differing mainly in their emphasis on communication versus knowledge services. Second, they employ similar technologies based on Web 2.0, including blogs, wikis, and RSS. Third, their user groups highly overlap, primarily comprising university students, faculty, and researchers, making virtual academic communities the main destination for user migration from subject service platforms.

Integration will transform the positioning of subject service platforms from mere navigation and literature management to more proactive services. It will facilitate connections not only between librarians and users but also among users

themselves, enabling tighter research collaboration, significantly improving service efficiency, and reducing librarians' workload.

4.4 Summary of Online Academic Services

Comparative investigation reveals substantial overlap between services provided by subject service platforms and virtual academic communities, with similarities but also significant differences. Subject service platforms excel in resource navigation services, offering "journal navigation," "institution navigation," and "database navigation" unavailable in virtual academic communities. "Document delivery" is a special service provided by university libraries, superior in quantity and quality to similar "document assistance" functions in virtual academic communities.

Based on the investigation, services can be divided into four categories: common services, similar services, subject service platform-specific services, and virtual academic community-specific services. Merging common and similar services and incorporating unique services from both platforms yields 26 online academic services, categorized by type as shown in Table 3 : basic services, navigation services, resource services, personalized services, information services, user feedback, discussion and communication, and information literacy.

4.5 Questionnaire Survey

4.5.1 Questionnaire Design The questionnaire consisted of two parts. The first part collected basic user information: gender, education level, age, and frequency of using virtual academic communities or subject service platforms. The second part was the Kano model questionnaire, which explained each of the 26 online academic services and posed both positive and negative questions with five response options: like very much, should be that way, indifferent, can accept, and dislike very much.

4.5.2 Questionnaire Collection, Processing, and Validation The survey was conducted both online and offline from November 2020 to January 2021. Online distribution included university QQ groups, WeChat groups, forums, virtual academic communities (Xiaomuchong), and the Credamo sample library. Offline distribution used paper questionnaires on campuses. A total of 600 questionnaires were collected, with 567 valid responses (94.50%) after eliminating invalid responses from users unfamiliar with the platforms or with contradictory answers.

Among valid respondents, 9.3% held bachelor's degrees, 71.1% master's degrees, and 19.6% doctoral degrees or higher. In terms of occupation, 45.5% were students, 24.5% faculty, 25.0% researchers, and 7.9% other professions. To ensure familiarity with online academic services, users who had never used virtual academic communities or subject service platforms were excluded, resulting in

40.9% using platforms daily, 48.7% at least weekly, and 10.4% at least monthly or rarely.

Reliability testing using SPSS yielded a Cronbach's Alpha of 0.881, indicating good reliability. For content validity, the 26 services were derived from analysis of current platforms without omission or duplication. SPSS validity testing showed KMO values of 0.824 for positive questions and 0.796 for negative questions, with Bartlett's sphericity test results of 0, confirming good validity.

4.5.3 Questionnaire Results Questionnaire results were imported into Excel and calculated according to the Kano evaluation classification 对照表 (Table 4). Initial classification showed services 1, 2, 3, 4, 5 as must-be; 6, 7, 8, 9, 11, 12, 13, 14, 18, 19, 22, 23, 24, 25, 26 as one-dimensional; 10, 20, 21 as attractive; and 15, 16, 17, 25, 26 as indifferent.

5 Classification of Subject Service Platform Functions

5.1 Kano Model Classification

Relying solely on frequency calculations to determine Kano types can yield inaccurate results when differences are small. Therefore, further calculation was required.

5.2 Mixed-Class Analysis

This study adopted the mixed-class analysis method proposed by M. Lee [22] to refine the Kano model. This method calculates two quantitative indicators: Total Strength (TS) and Category Strength (CS) to adjust Kano classifications:

$$TS = \frac{(M + O + A)}{(M + O + A + I + R + Q)}$$

$$CS = \frac{[\max(M, O, A, I, R, Q) - \text{secondmax}(M, O, A, I, R, Q)]}{(M + O + A + I + R + Q)}$$

TS reflects whether a service element satisfies respondents, while CS indicates the degree of agreement that the element belongs to its current Kano category. When TS $\geq$ 60% and CS $<$ 6%, the element is classified as mixed-class.

Mixed-class calculations revealed adjusted Kano categories (Table 6), where H represents mixed-class with the two dominant Kano types in parentheses. Service 1 was attractive/must-be mixed; service 4 was must-be/indifferent mixed; and service 21 was attractive/indifferent mixed.

5.3 Better-Worse Coefficient Analysis

Building on the Kano model, Better-Worse coefficients proposed by C. Berger et al. [23] were used for further analysis. Better coefficient represents satisfaction improvement when a service is added (closer to 1 indicates greater impact), while Worse coefficient represents dissatisfaction when a service is eliminated (closer to -1 indicates greater impact):

$$\text{Better} = \frac{(A+O)}{(A+O+M+I)}$$

$$\text{Worse} = -\frac{(O+M)}{(A+O+M+I)}$$

Based on the Kano results (Table 6), coefficients were calculated. The average Better coefficient was 0.59 and average absolute Worse coefficient was 0.48, used to divide the coordinate system into four quadrants (Figure 1 [Figure 1: see original paper]):

Quadrant I (Expected Services): Both Better and absolute Worse coefficients exceed averages, including services 6, 7, 8, 9, 12, 13, 14, 19, 22, 23, 24. These services significantly improve satisfaction when provided and substantially reduce satisfaction when absent.

Quadrant II (Must-be Services): Low Better but high absolute Worse coefficients, including services 1, 2, 3, 4, 5, 18. These have limited impact on satisfaction when provided but cause significant dissatisfaction when absent.

Quadrant III (Indifferent Services): Both coefficients below averages, including services 10, 11, 20, 21. These have minimal impact on satisfaction whether provided or not.

Quadrant IV (Attractive Services): High Better but low absolute Worse coefficients, including services 10, 11, 20, 21. These improve satisfaction when provided but do not cause dissatisfaction when absent.

Discrepancies for services 11 and 18 likely resulted from: (1) questionnaire length affecting respondent patience, and (2) inability to verify respondents' actual familiarity with platforms during online collection.

6 Conclusions and Recommendations

6.1 Analysis of Mixed-Class Services

Mixed-class results showed the subject homepage as attractive/must-be mixed, database navigation as must-be/indifferent mixed, and thematic discussion as attractive/indifferent mixed. Although classifications were ambiguous, combining Better-Worse analysis with the theory that Kano types transition over time (I → A → O → M) [24] reveals that subject homepage and database navigation

are transitioning toward must-be services, indicating stabilizing user demand that should be managed as must-be services. Thematic discussion is transitioning from indifferent to attractive, requiring increased attention.

6.2 Focus on Expected Services

Expected services include document downloading, resource retrieval, document delivery, personal center, favorites, research tracking, subject information, resource recommendation, research collaboration, research sharing, and group communication. Document downloading, the most expected service, and resource retrieval are closely related and critically important for satisfaction. These require prioritized development with increased funding and personnel for operation and maintenance, focusing on integrating electronic resources across FULink member libraries and managing heterogeneous resources. Document delivery must also be accurate, efficient, and convenient when normal downloading is unavailable.

Resource recommendation, an expected service not yet implemented in FULink but available in other platforms, could link to library acquisition recommendation systems. Research collaboration, research sharing, and group communication, derived from virtual academic communities using wiki, Web 2.0, and BBS technologies, are currently unavailable in university subject service platforms. FULink could provide online collaborative creation, file upload/download, and online communication services, or add forum sections and QQ/WeChat group access to leverage its large librarian and user base.

6.3 Continuously Improve Must-be Services

Must-be services include subject homepage, journal navigation, expert navigation, database navigation, institution navigation, and reference consultation. These require no major changes but cannot be neglected as foundational services.

The subject homepage has a high absolute Worse coefficient, making it indispensable. Management should create distinct homepages for different disciplines, continuously launch new subject platforms, and display services according to Better-Worse coefficient priorities. Future research could conduct discipline-specific surveys to determine varying needs.

Reference consultation, with a Better coefficient near the average, requires adequate human resources to ensure real-time communication between librarians and users. Integrating traditional reference consultation into the platform enables real-time online consultation, eliminating temporal and spatial barriers. Drawing from other platforms, FULink should add FAQ lists or intelligent robots to streamline processes and avoid repetitive work for librarians.

6.4 Ensure Provision of Attractive Services

Attractive services include academic recommendation, statistical analysis, online modification, and thematic discussion. Beyond expected and must-be services, these should be guaranteed.

Statistical analysis significantly impacts user satisfaction. While FULink currently provides this service, it focuses on overall subject analysis with limited personal data statistics. Subject service platforms should incorporate personal information management, favorite/subscription management, browsing history, and message centers to support unified management of literature resources throughout the research process.

Thematic discussion, a mixed indifferent/attractive service in transition, has potential. Since research collaboration, research sharing, and group communication (all providing discussion functions) are classified as expected services and inseparable from thematic discussion, platforms should seize this transition opportunity to add this service and improve satisfaction.

Academic recommendation is a distinctive FULink service, centered on users, supported by member library resources and subject librarians, and employing big data analysis and precise information distribution to provide professional, personalized, and ubiquitous research process support. Both subject service platforms and virtual academic communities prominently feature this service, warranting sufficient attention.

6.5 取舍 of Indifferent Services

Indifferent services include research positions, funding updates, conference announcements, thesis writing guidance, and course lectures. Thesis writing and course lectures, as information literacy services specific to subject service platforms, had low Better-Worse coefficients and showed minimal content and maintenance in early investigations. These could be reduced or postponed for platforms not yet providing them.

Research positions, funding updates, and conference announcements are information services. Since subject information (similar content) is classified as expected, these could temporarily be incorporated into subject information sections, with independent operation decisions based on traffic volume.

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