Research on the Current Status and Development Strategies of University Mobile Library Service Models: Postprint

Authors: Xu Tiancai, Pan Yuting, Feng Tingting, Yang Xinya, Wei Qunyi, Yuan Hui

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Abstract

[Purpose/Significance] The demand for readers to access library information services via mobile terminals is becoming increasingly prominent; however, the development of mobile library service models is plagued by issues such as monolithic development approaches, lack of humanistic features, and suboptimal service effectiveness. This study investigates and analyzes cases to identify strategies for constructing and developing university mobile library service models, thereby providing a crucial reference for implementing library mobile services.

[Method/Process] This research examines the current status and development strategies of three service models—APP clients, mobile web versions, and WeChat platforms—by taking mobile libraries of 42 "Double First-Class" universities as the study objects and employing network and literature investigation methods alongside case analysis.

[Results/Conclusion] The investigation reveals that mobile library APP clients and mobile web pages predominantly utilize fixed templates, leading to severe homogenization of content and functionality and resulting in poor user experience. The maintenance of WeChat Official Accounts is inconsistent, and the adoption rate of mini programs remains low. Prioritizing quality over comprehensiveness, developing mobile library services with strategic focus, innovating WeChat library development, and enhancing service promotion constitute essential measures for improving mobile library services.

Full Text

Preamble

Research on Current Status and Development Strategies of Mobile Library Service Models in Universities

Xu Tiancai[1,2], *Pan Yuting*[3], *Feng Tingting*[3], *Yang Xinya*[1,2], *Wei Qunyi*[1,2], *Yuan Hui*[1]

[1]Chongqing University Library, Chongqing 400044
[2]Institute for Advanced Studies in Humanities and Social Science, Chongqing University, Chongqing 400044
[3]School of Economics and Business Administration, Chongqing University, Chongqing 400044

Abstract: [Purpose/Significance] The demand for accessing library information services through mobile terminals has become increasingly prominent among readers. However, the construction of mobile library service models faces problems such as monotonous development forms, lack of humanistic features, and poor service effectiveness. Through case investigation and analytical research, this study seeks construction and development strategies for university mobile library service models, providing important reference for the development of library mobile services. [Method/Process] Taking the mobile libraries of 42 "Double First-Class" universities as research objects, this study employs network investigation, literature research, and case analysis methods to examine the current status and development strategies of three service models: APP clients, mobile web pages, and WeChat platforms. [Result/Conclusion] The investigation reveals that mobile library APP clients and mobile web pages generally use fixed templates, resulting in serious homogenization of content and functions and poor user experience. WeChat Official Account maintenance varies significantly in quality, and the penetration rate of Mini Programs is not high. Focusing on quality over comprehensiveness, developing mobile library services with emphasis, innovating WeChat library development, and improving service promotion will become important measures to enhance mobile library services.

Keywords: mobile library; service model; adaptive webpage; WeChat library; APP client
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The rapid development of the Internet and mobile terminal devices is changing people's reading habits, and as an important provider of reading services, libraries are profoundly affected in their service models. Mobile reading-centered library services have been rapidly developed and widely accepted. Providing mobile reading services that satisfy readers' needs to access libraries via mobile terminals through the Internet has become an important part of library work. The demand for mobile reading services is particularly prominent among university library user groups. SMS services were the first mobile service method adopted,

mainly including simple notification services such as due date reminders. Meanwhile, WAP website services emerged and quickly became the mainstream form of mobile library services. APP client-based mobile libraries started relatively late, and currently only a small number of universities have attempted deployment. The explosive growth of WeChat in 2011, with its rapidly expanding user base and stable usage time, created a unique platform for promoting mobile reading services. Meanwhile, the WeChat Official Account platform, with its novel user experience and low access threshold, opened a new chapter for library mobile services. Domestic university libraries have successively opened WeChat Official Accounts, making WeChat libraries a new model for mobile library services.

In comparison, foreign mobile library theory and practice started earlier and are more widely applied. The forms of foreign university mobile libraries are basically consistent with domestic ones, with differences mainly in service content. In addition to traditional library services such as book borrowing, catalog searching, and user account management, they also provide extended services such as location navigation, mobile reservation, mobile printing, and links to blogs or social networks. For example, the University of Oregon Library uses location-based technology to provide services such as Historical Location and Walking Tours for users. Athabasca University in Canada developed the MLibrary mobile library project, where the website identifies the mobile device used by the user and matches it with an appropriate version of digital resources, enabling users to access them anytime and anywhere. Regardless of domestic or foreign contexts, the emergence of mobile libraries has had a profound impact on library services.

Research Status

Mobile libraries can be divided into four modes according to different access paths: SMS, APP client, WAP webpage, and WeChat platform. With the continuous improvement of mobile library usage environments and devices, SMS services are no longer suitable for the Internet environment. Therefore, the main service forms of current domestic university mobile libraries are APP client, mobile webpage, and WeChat platform. Many university libraries have also opened official Weibo accounts, but since Weibo only serves as an information release platform without specific business functions, it cannot truly provide mobile library services. The new WeChat platform has posed a huge impact on APP clients and mobile web pages, while the limitations of library technology and funding have caused mobile libraries under traditional service paths to fall into a dilemma.

The construction and development of mobile libraries in Chinese universities mainly face the following problems: (1) University library technology is imperfect, making it difficult to independently develop mobile libraries with high technical content; (2) Mobile library development models are single, with multiple universities using the same template, lacking individuality and features,

and having single functions and poor practicality compared with European and American universities; (3) Mobile library function interfaces are roughly developed, resulting in poor user experience; (4) University libraries have limited funds but blindly pursue comprehensiveness in reading service construction and development, with diverse service models that are difficult to gain reader recognition. These problems have led to university libraries investing significant effort to seemingly provide rich and diverse mobile library services, but in reality, these services are difficult to promote, have low attention, and cannot meet user needs.

Therefore, regulation and optimization of mobile library service models are imperative, and relevant research cannot provide assistance for the development strategies of university libraries in mobile library development and construction. To solve the above problems and further explore the problems and cruxes of the three mainstream mobile library service models, this paper selects 42 "Double First-Class" university libraries as research objects, investigates the current development status of the three mobile service models—APP client, mobile webpage, and WeChat platform—among these 42 libraries, analyzes them one by one, and proposes targeted improvement strategies to optimize mobile library service models, clarify service goals and priorities, and provide important reference for the next step of domestic university mobile library development.

Survey Methods

Considering that the 42 "Double First-Class" university libraries are more superior to other domestic universities in terms of funding, technology, equipment, and talent, making them more representative for mobile library service research, this paper takes these 42 libraries as research objects and conducted the survey from December 1 to 23, 2018 (all data in this paper were obtained before December 24, 2018). The survey mainly investigated the development status of three forms of mobile libraries: APP client, mobile webpage, and WeChat platform.

The specific survey process was as follows: (1) First, visit the homepage of the university's digital library to obtain mobile library access links; (2) Access the APP client and mobile webpage version of the mobile library according to the links; (3) For universities that did not provide APP client and mobile webpage access links, consider that they have not yet opened this form of mobile library; (4) Search for WeChat library information in the WeChat search box using "university name + library" as the keyword. To control experimental variables and reduce operational errors, the equipment used in this survey is described in Table 1 .

According to the survey, all 42 "Double First-Class" universities have launched mobile library services, with the current status shown in Table 2 . Meanwhile, WeChat libraries have become the main battlefield for major universities to launch mobile services, with a launch rate exceeding 90%. Among them, 33 "Double First-Class" universities, including Renmin University of China and

Beihang University, display QR codes or links for WeChat library access on the homepage of their digital libraries, facilitating users' direct and quick access.

Table 2. Statistics on the Development of Three Mobile Library Models Among 42 "Double First-Class" Universities

Mobile Library Form	Number of Libraries	Percentage (%)
APP client	27	64.29
Mobile webpage	27	64.29
WeChat platform	41	97.62

Note: Data for APP client and mobile webpage models are based on official access guidance from university libraries, while WeChat library data are based on actual search results in WeChat.

Analysis of Mobile Library Service Model Status

4.1 APP Client

University APP client-based mobile libraries mainly include two service models: templated APPs based on commercial companies and personalized APPs. There are also forms such as custom APPs developed by commercial companies and mobile services embedded in the university's own APP. Survey results show that 13 university libraries did not mention whether they provide mobile library APPs in official channels; 22 adopted templated APPs provided by Chaoxing or Huiwen companies; Tsinghua University Library uses an APP client developed by Shusheng Company, but the university website states that the service has been suspended; Zhengzhou University Digital Library was inaccessible during the survey period; three universities—Jilin University, Southeast University, and Zhejiang University—developed personalized mobile library APP clients. It is worth mentioning that Yunnan University, Kunming University of Science and Technology, and Yunnan University of Finance and Economics jointly use a customized Huizhi Space mobile APP client developed by Guangzhou Tuchuang Computer Software Development Co., Ltd., providing mobile library services for teachers and students. Central South University embeds library mobile services in its university's mobile APP. Although these two methods have not been widely adopted, they represent new approaches for libraries to develop APP client-based mobile services. The survey results are shown in Table 3 .

Table 3. Development Status of Mobile Library APP Clients Among 42 "Double First-Class" Universities

APP Client Type	Number of Libraries
Providing templated APP client	22
Providing personalized APP client	3

APP Client Type	Number of Libraries
Custom APP	2
No APP client	13

Note: The APP client of Tsinghua University Library is suspended, and Zhengzhou University Digital Library was inaccessible during the survey period.

Compared with other forms of mobile library services, APP clients, especially excellent ones, can achieve richer and more powerful system functions. For example, the Jilin University Library APP client provides nearly 20 functions including collection search, renewal, announcements, database navigation, videos, bookshelves, open courses, academic resources, newspapers, and scan functions (see Figure 1 [FIGURE:1]). However, from the actual development status of "Double First-Class" universities, APP construction and development require high funding and technical starting points, and promotion is difficult. Moreover, 52.4% of university libraries provide templated products developed by commercial companies, which have defects such as single form, lack of features, and low reader acceptance. Only 7.1% of university libraries provide personalized mobile library APP clients, while as many as 30.9% have not yet opened APP client services.

4.2 Mobile Web Version

Mobile webpage-based mobile library development can be said to be one of the most widely used mobile library service forms. Mobile webpage-based libraries have experienced two development periods: from WAP protocol to HTTP protocol.

4.2.1 Based on WAP Protocol WAP (Wireless Application Protocol) is an application protocol standard that realizes the combination of mobile phones and the Internet. WAP protocol is a protocol customized for wireless environments with narrow bandwidth, high latency (transmission environment), small screens, limited storage capacity, and low processing capacity (mobile terminals). In the early stage of mobile reading development, the WAP protocol could be said to be the best solution. Traditional WAP 1.0 uses simpler WML (Wireless Markup Language) as the markup language, which also leads to relatively simple and single webpage content and functions. With the upgrade of Internet technology and mobile phone performance, XHTML (eXtensible HyperText Markup Language) is used as the markup language for WAP 2.0, greatly improving data transmission performance and making webpage elements more diverse.

Nevertheless, WAP-based mobile libraries still inevitably have many problems. The biggest flaw is that every function expansion requires developers to rewrite programs and build website frameworks, resulting in long development cycles

and high costs. With the further upgrade of mobile Internet technology and smart terminal devices, HTML5 standards and CSS3 technologies based on the HTTP protocol enable mobile devices to display webpages with more diverse functions through less development. Under this trend, libraries have gradually eliminated WAP protocol for developing mobile libraries and adopted the more convenient and practical HTTP protocol.

4.2.2 Based on HTTP Protocol HTTP (HyperText Transfer Protocol) is the most widely used network protocol on the Internet. The markup language used by the HTTP protocol, HTML (HyperText Markup Language), is also currently the most widely used language on the network. Modern Internet usually uses HTML to record information content. HTML webpages are not platform-limited and can be widely used on devices such as computers and mobile phones.

The detailed survey of HTTP protocol-based mobile libraries is as follows: (1) Among the 42 "Double First-Class" university libraries, 14 have not yet provided access links to mobile libraries developed based on the HTTP protocol; (2) The mobile webpage version of the mobile library co-developed by Tsinghua University Library and Shusheng Company has suspended service; (3) Zhengzhou University Library was temporarily inaccessible during the survey period; (4) Among the 26 "Double First-Class" university libraries that clearly offer webpage-based mobile library services, 22 cooperate with Chaoxing or Huiwen companies to provide standard modular services; only four "Double First-Class" university libraries—Peking University Library, Dalian University of Technology Library, Southeast University Library, and University of Science and Technology of China Library—provide personalized webpage-based mobile library services. Screenshots are shown in Figure 2

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The development technology and cost of webpage-based mobile libraries are relatively lower than those of APP clients, but few university libraries choose to develop this service independently. More than half of the "Double First-Class" university libraries cooperate with Chaoxing or Huiwen companies to launch services. The content and functions of these mobile library pages are completely consistent, with only the school name displayed differently (see Figure 3

). Although cooperating with commercial companies saves time and effort in development and maintenance, it has the same problem as APP clients: libraries can only use fixed function modules, essentially giving up the initiative for function development and expansion. Moreover, mobile libraries have not integrated with the university library's culture, making it impossible to cultivate user belonging and difficult to gain reader recognition. The survey data objectively reflects that university libraries lack personnel and funding in technology development, making independent research and development difficult.

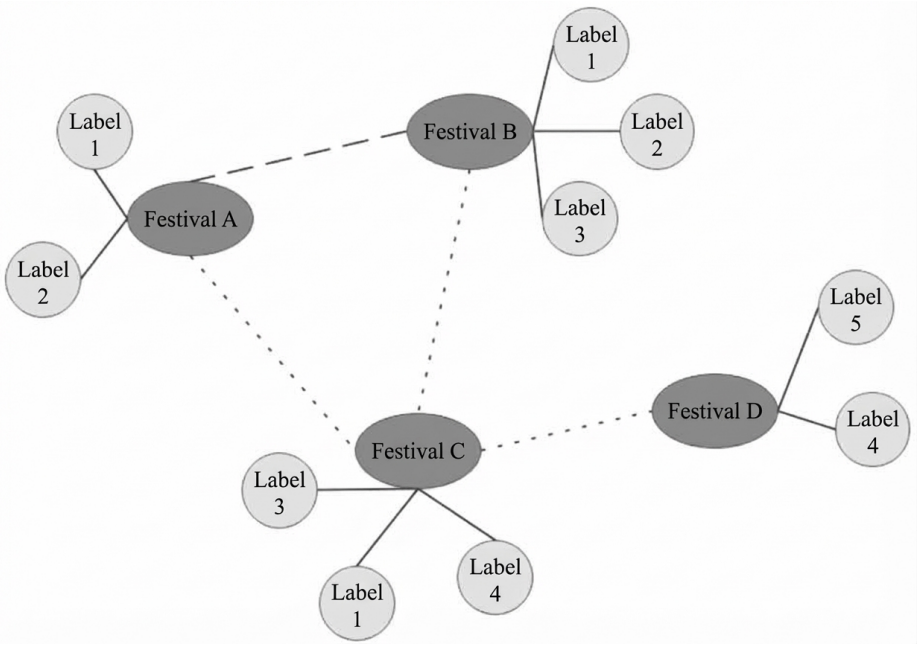

Figure 1: Figure 2

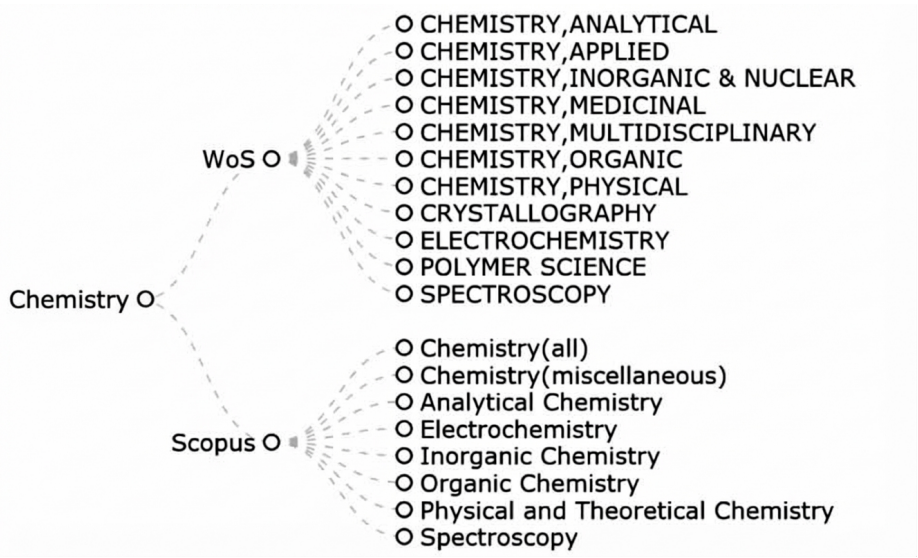

Figure 2: Figure 3

4.3 WeChat Platform

According to the "2018 WeChat Annual Data Report," as of September 2018, WeChat's monthly active users reached 1.082 billion. Providing mobile library services through the WeChat platform has become an important battlefield for library mobile services. WeChat libraries have three forms: service accounts, subscription accounts, and Mini Programs. WeChat service accounts focus on functional services and can customize function menus; WeChat subscription accounts focus on information push and can send group messages in the form of articles, pictures, and text to subscribers; WeChat Mini Programs, as applications that do not require download or installation, have the advantages of flexible operation, fast response, and convenient use. In terms of development difficulty and maintenance cost: WeChat Mini Programs > WeChat service accounts > WeChat subscription accounts. WeChat subscription accounts and service accounts are the mobile library forms with the lowest development technology and maintenance cost requirements.

By the time of the survey, all "Double First-Class" university libraries except China Agricultural University Library had opened WeChat libraries. Nineteen "Double First-Class" university libraries opened WeChat service accounts, and 26 opened WeChat subscription accounts, including six that opened both service and subscription accounts. The list and primary functions are shown in Table 4 .

Table 4. Six "Double First-Class" University Libraries with Both WeChat Service and Subscription Accounts

Service Account Name	Service Account Primary Functions	Subscription Account Name	Subscription Account Primary Functions
Harbin Institute of Technology Library Service Account	1. My Library 2. Book Search 3. Information Resources	Harbin Institute of Technology Library	1. Service Portal 3. Activity Information
Fudan University Library Service Account	1. Service Portal 3. Activity Information	Fudan University Library	1. My Library 3. Activity Information
Ocean University of China Library Service Account	1. Reader Center 2. Search Center 3. FAQ	Ocean University of China Library	1. Micro Service Hall 2. Library News 3. Resource Services

Service Account Name	Service Account Primary Functions	Subscription Account Name	Subscription Account Primary Functions
Tongji University Library	1. My Library 2. Search Center 3. FAQ	Tongji University Library Information Service	1. My Library 3. Common Services
Nanjing University Library Service Account	1. My Library 2. Search Center 3. Century Celebration	Nanjing University Library	1. Micro Service Hall 2. Library News 3. Resource Services
Hunan University Library Service Account	1. My Library 2. Search Center 3. FAQ	Hunan University Library	1. My Library 3. Activity Information

4.3.1 WeChat Service Account WeChat service accounts focus on providing functions while weakening information push, with only four group messages allowed per month. Among the surveyed objects, 13 "Double First-Class" university libraries opened only WeChat service accounts without subscription accounts. Detailed primary and secondary functions are shown in Table 5 .

From the perspective of primary function menu settings, university libraries mainly set up function themes such as information, services, and search. Sorting out the secondary functions of WeChat service accounts reveals that WeChat library functions usually revolve around three categories: library-related information, user personal services such as borrowing/renewing books, and collection search and electronic resource mobile access, corresponding to the primary function themes of information, services, and search. In addition, there are extended functions such as Bokan reading aloud, scanning code for book search, and reader recommendation. These basically cover all commonly used library functions and can meet users' daily needs. Although WeChat service accounts provide relatively comprehensive functions and services, they do not pay enough attention to communication and interaction between mobile libraries and users. In the survey, only five "Double First-Class" university libraries—Minzu University of China Library, Dalian University of Technology Library, Central South University Library, Chongqing University Library, and Northwest A&F University Library—clearly provided social functions such as online consultation, contact us, and problem feedback, accounting for only 26.31%. If the social functions of WeChat itself cannot be utilized, the maximum benefits of building a mobile library on the WeChat platform will be lost.

4.3.2 WeChat Subscription Account WeChat service accounts are displayed directly in the WeChat chat list as separate conversation boxes, while WeChat subscription accounts are viewed in the subscription account list. A comparison screenshot is shown in Figure 4

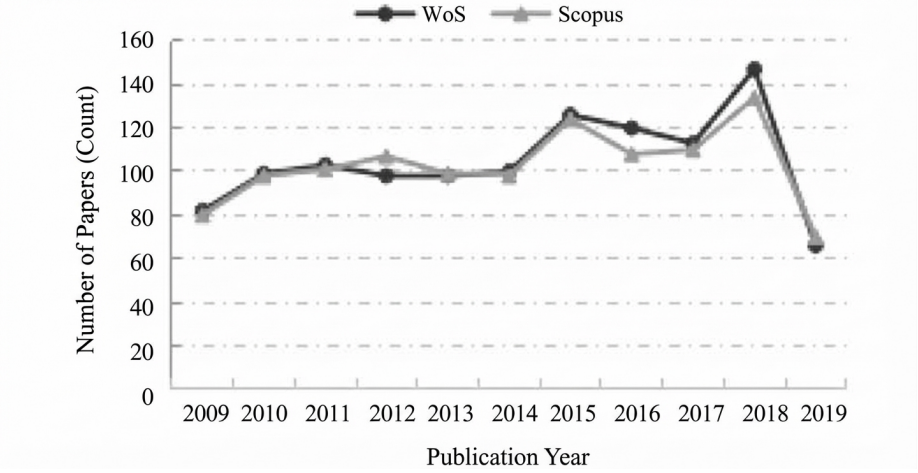

Figure 3: Figure 4

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The function positioning of WeChat subscription accounts is to publish information push. Each account can send one group message per day, and each group message can contain multiple article links. Due to the lowest threshold for opening WeChat subscription accounts, 22 “Double First-Class” university libraries (excluding those with both service and subscription accounts) opened WeChat subscription accounts, accounting for more than 50%.

The role of WeChat subscription accounts is message push. For mobile libraries, they focus more on information release, making push frequency and content important standards for measuring account service quality. This paper investigates the push status of WeChat subscription accounts of 22 “Double First-Class” university libraries. Data were obtained on December 23, 2018, investigating the account maintenance status from December 1-15, 2018, and counting the daily average push volume, days of update suspension, and total number of articles pushed within 15 days. The daily average push volume and total number of articles can directly reflect subscription account maintenance status, while the number of days of update suspension reflects the degree of maintenance. Usually, more suspension days indicate inadequate maintenance. Combining these three indicators shows the maintenance, updating, and activity level of university library WeChat subscription account content. The most recent push from Beijing Institute of Technology Library’s WeChat subscription account was on September 26, with only three pushes published in 2018, indicating poor ac-

count maintenance. The specific maintenance status of the other 21 "Double First-Class" university library WeChat subscription accounts is shown in Table 6 .

More than half of the "Double First-Class" university library WeChat subscription accounts have push publishing below average, lacking timely release of library information. Of course, excessively high push frequency and number of articles make it difficult to guarantee article quality and affect user experience. It is recommended that libraries publish high-quality article pushes timely according to their own circumstances to enhance service quality.

4.3.3 WeChat Mini Program On November 3, 2016, the WeChat team officially announced that WeChat Mini Programs were open for public testing. Mini Programs have the advantages of light memory and fast response that APP clients cannot match, which will undoubtedly have a significant impact on libraries' self-media service models, channels, and content. The author previously investigated the development of WeChat Mini Programs among 42 "Double First-Class" university libraries in June 2018, when only Peking University Library had released a Mini Program. By December 2018, five "Double First-Class" university libraries had released their library Mini Programs, and another three "Double First-Class" university libraries provided Mini Program functions (see Table 7), showing extremely rapid development speed.

The main problems currently existing in mobile libraries in the form of WeChat Mini Programs are, on the one hand, the low launch rate, which may be due to the relatively short time since this function was launched. On the other hand, the problem lies in unclear function access entrances: the survey found that the Mini Program functions provided by Xiamen University Library, Wuhan University Library, Northeastern University Library, and Yunnan University Library cannot be searched under the Mini Program tab using the "university name + library" method, lacking search relevance; the WeChat Mini Programs of Minzu University of China Library, Shanghai Jiao Tong University Library, and Ocean University of China Library cannot be accessed through the "related Mini Programs" menu at the bottom of the Official Account, which also makes it difficult for users to discover function entrances and limits the promotion and use of Mini Programs.

Improvement Strategies for Mobile Library Service Models

5.1 Focus on Quality Over Comprehensiveness

Survey results show that 18 "Double First-Class" university libraries simultaneously opened three mobile library service models: APP client, mobile webpage, and WeChat platform. However, almost no university library has successfully developed all three service models into ones recognized by readers. This development approach that one-sidedly pursues comprehensiveness, under the current objective conditions of university libraries, is not only unfavorable for the de-

velopment of library mobile services but may also seriously hinder the future construction and development of mobile libraries after wasting substantial human and material resources. At present, except for a few university libraries, most do not have the capability to independently develop APP clients. On the one hand, smartphones have multiple systems such as iOS and Android, requiring APP clients to be adapted and developed differently for different operating systems, resulting in extremely high development costs and difficulty. From the system maintenance perspective, every time the mobile phone system is upgraded, developers need to perform maintenance operations such as repairing and upgrading the APP client, and users need to manually update the system, resulting in extremely high maintenance costs.

Although cooperating with commercial companies to develop templated APP clients can reduce development and maintenance burdens to a certain extent, libraries cannot actively develop characteristic services based on unique humanistic attributes. On the other hand, from the user usage perspective, APP clients have high requirements for devices and network speed, occupy mobile phone memory, and face certain difficulties in promotion among reader groups.

There are many mobile library service forms available for universities to choose from, and the development of mobile libraries has passed the era of pursuing quantity and comprehensiveness. University libraries do not need to pursue coverage of every form and can completely abandon the APP client that requires much effort but yields little appreciation, instead concentrating energy and funding on mobile library forms that their libraries are better at. For example, Peking University Library does not provide an APP client but focuses on the development and maintenance of the WeChat platform, being the first "Double First-Class" university library to open a WeChat Mini Program. Screenshots of Peking University's WeChat Mini Program pages and functions are shown in Figure 5

. Therefore, based on survey results and analysis, university libraries should focus their reading service model construction on mobile webpage and WeChat library models.

5.2 Webpage Quality Improvement

5.2.1 Consistency with Digital Portal The development of mobile webpage-based libraries faces a similar situation to APPs: due to limited development technology, most university libraries choose to cooperate with commercial companies to provide templated commercial products. Usually, the access links of mobile webpages are inconsistent with computer portal websites, requiring users to obtain mobile library access links through access guidance provided by the portal website, which is cumbersome. Meanwhile, templated commercial products also lead to mobile libraries lacking personality and creativity, being monotonous, and even lacking the functions and resources contained in the portal website. These mobile webpage-based libraries usually

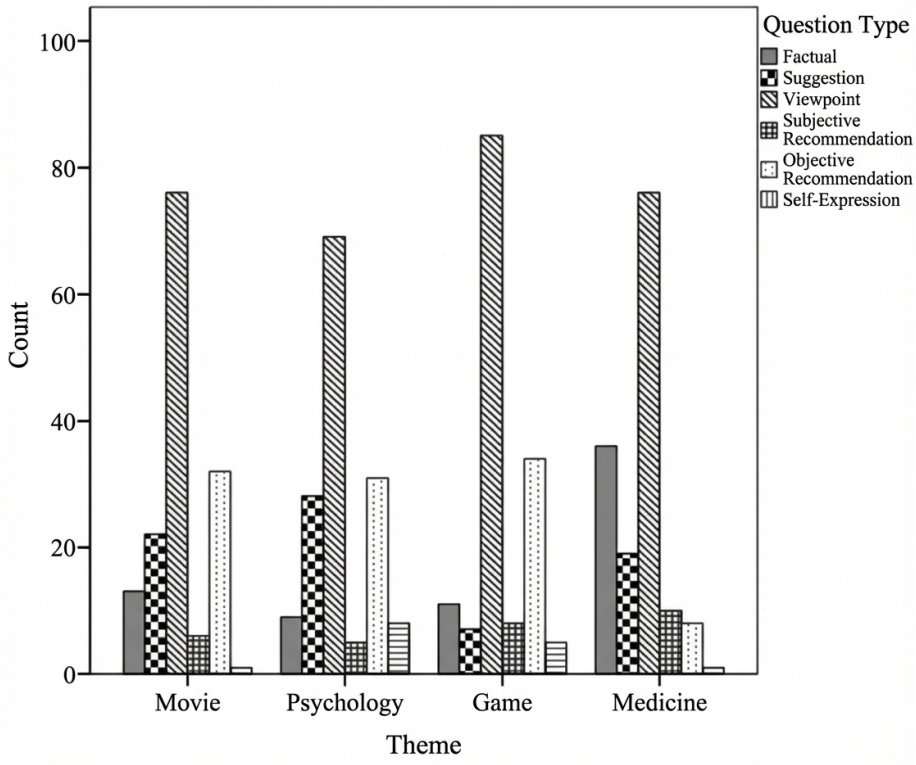

Figure 4: Figure 5

have single functions and simple interfaces to adapt to mobile terminals, making them unattractive to users. These problems have caused mobile webpage-based libraries to fall into a predicament.

With the progress of the Internet and mobile terminal devices, especially the popularization of smartphones, the reduction of data fees, and the maturity of WiFi technology, maintaining consistency between mobile webpage-based libraries and digital library portal websites has become the best solution strategy to get out of the predicament. This can achieve a qualitative leap in access speed, port access, and functions, and completely solve the differentiation of reading services between mobile and PC ends caused by previously insufficient Internet technology. In the survey, except for Zhengzhou University Library's webpage being temporarily inaccessible, the other 41 "Double First-Class" university libraries can all be accessed directly through mobile browser searches, with an effective access rate as high as 97.62%. Maintaining consistency between mobile libraries and portal websites is equivalent to transferring all functions and content of the library portal website to mobile access. Libraries can easily achieve "develop once, use multiple times," and users can also "learn once, use on multiple devices."

5.2.2 Enhanced Adaptive Webpage Design Mobile phones and computers have significant differences in screen size and shape, making it difficult to obtain the same user experience as computers. Therefore, research on "adaptive webpage design" has emerged. The concept of "adaptive webpage design" was proposed by E. Marcotte in 2010, referring to webpages that can automatically identify the screen width of device windows and automatically adjust webpage display content and layout. The survey found that 15 "Double First-Class" university libraries can achieve webpage adaptation when accessed by mobile phones, but nearly two-thirds of "Double First-Class" university digital libraries cannot achieve webpage adaptation when accessed by mobile browsers, with pages displaying either too small or distorted, resulting in poor user experience that is unfavorable for library services.

The development of mobile terminal webpage-based libraries can adopt the latest HTML5 (the fifth major revision of HyperText Markup Language) specification to build website frameworks, perfectly solving webpage adaptation problems and enabling users to easily obtain the same user experience as on the computer end on their mobile phones. Webpage quality is an important standard to ensure mobile library services are recognized by readers. Maintaining consistency between mobile webpages and digital portals and achieving good adaptability of mobile library webpages can not only reduce readers' learning costs for using library functions on mobile terminals but also truly guarantee readers' user experience on mobile terminals.

5.3 Leveraging WeChat Development Momentum for Mobile Reading

5.3.1 WeChat Advantages Developing mobile library services based on the WeChat platform has lower development costs than APP clients, faster access speed than mobile webpages, and the promotion problem of mobile library services will be solved on a platform with over 1 billion monthly active users. The WeChat platform itself is a mobile APP widely used by university students in their daily lives, fully supporting multiple system terminals such as iOS and Android. University libraries can give full play to various advantages of the WeChat platform, integrating social interaction, mobile services, and article publishing: (1) Through WeChat's one-on-one communication function, effectively communicate and interact with users; (2) Use the function menu of Official Accounts to provide mobile library services for users according to the library's situation; (3) Improve the quality of article content, maintain stable article publishing frequency, and continuously attract user attention.

On this basis, university libraries can also use WeChat's advanced functions to enrich mobile library services. For example, many university libraries use WeChat's "Scan" function to develop book recommendation by scanning codes; many university libraries also develop audio and video services such as Bokan reading aloud based on WeChat's multimedia functions. In addition, location-based services can be combined with current seat reservation and panoramic VR services to provide location-based library space services according to WeChat's positioning function. WeChat's quick payment function can also be used to add mobile services such as online book purchasing and online fine payment, making WeChat libraries closer to users' daily lives and more convenient for cultivating user habits.

5.3.2 WeChat Mini Program Innovative Services WeChat Mini Programs are described as "no need to install, accessible at hand, use and go, no need to uninstall," and have opened a new Internet ecology. Compared with traditional APP clients, Mini Programs are simple to develop, convenient to maintain, smooth to use, and powerful in function, and can completely replace APP clients. At the same time, Mini Programs have all the advantages of the WeChat platform and are bound to become a new form of mobile library. The "Double First-Class" university libraries that have opened WeChat Mini Programs all have clear function positioning. For example, Shanghai Jiao Tong University Library's Mini Program is mainly a seat reservation system to help users timely grasp library seat usage; Xiamen University Library's Mini Program is mainly a literature retrieval system, providing published achievement information for Xiamen University scholars (see Figure 7

).

WeChat Mini Programs have achieved rapid development since their launch, with various fields including food, takeout, video, games, and shopping already occupying the Mini Program market. University libraries should also attach

Free Q&A:

$$Y_{\text{Answer Length}} = \beta_0 + \beta_1 X_{\text{Question Length}} + \beta_2 X_{\text{Factual Type}} + \beta_3 X_{\text{Suggestion Type}} + \beta_4 X_{\text{Subjective Recommendation Type}} + \beta_5 X_{\text{Objective Recommendation Type}} + \beta_6 X_{\text{Self-expression Type}} + \beta_7 X_{\text{Psychology}} + \beta_{10} X_{\text{Question Pasting Time}} \quad \text{(Formula 1)}$$

$$Y_{\text{Answer Quantity}} = \beta_0 + \beta_1 X_{\text{Question Length}} + \beta_2 X_{\text{Factual Type}} + \beta_3 X_{\text{Suggestion Type}} + \beta_4 X_{\text{Subjective Recommendation Type}} + \beta_6 X_{\text{Self-expression Type}} + \beta_7 X_{\text{Psychology}} + \beta_8 X_{\text{Game}} + \beta_9 X_{\text{Medicine}} + \beta_{10} X_{\text{Question Pasting Time}} \quad \text{(Formula 2)}$$

$$Y_{\text{Evaluation Quantity}} = \beta_0 + \beta_1 X_{\text{Question Length}} + \beta_2 X_{\text{Answer Length}} + \beta_3 X_{\text{Factual Type}} + \beta_4 X_{\text{Suggestion Type}} + \beta_5 X_{\text{Secommendation Type}} + \beta_6 X_{\text{Objective Recommendation Type}} + \beta_7 X_{\text{Self-expression Type}} + \beta_{10} X_{\text{Medicine}} + \beta_{11} X_{\text{Question Posting Time}} + \beta_{12} X_{\text{Answer Posting Time}} \quad \text{(Formula 3)}$$

Paid Q&A:

$$Y_{\text{Answer Length}} = \beta_0 + \beta_1 X_{\text{Historical Answer Count}} + \beta_2 X_{\text{Price}} + \beta_3 X_{\text{Question Length}} + \beta_4 X_{\text{Factual Type}} + \beta_5 X_{\text{Suggestion Type}} + \beta_7 X_{\text{Objective Recommendation}} + \beta_8 X_{\text{Self-expression Type}} + \beta_9 X_{\text{Psychology}} + \beta_{10} X_{\text{Game}} + \beta_{11} X_{\text{Medicine}} + \beta_{12} X_{\text{Question Posting Time}} \quad \text{(Formula 4)}$$

$$Y_{\text{Evaluation Quantity}} = \beta_0 + \beta_1 X_{\text{Historical Answer Count}} + \beta_2 X_{\text{Price}} + \beta_3 X_{\text{Question Length}} + \beta_4 X_{\text{Answer Length}} + \beta_5 X_{\text{Factual Type}} + \beta_6 X_{\text{Suggestion Type}} + \beta_7 X_{\text{Objective Recommen}} + \beta_9 X_{\text{Self-expression Type}} + \beta_{10} X_{\text{Psychology}} + \beta_{11} X_{\text{Game}} + \beta_{12} X_{\text{Medicine}} + \beta_{13} X_{\text{Question Posting Time}} \quad \text{(Formula 5)}$$

Figure 5: Figure 7

great importance to the Internet wave triggered by Mini Programs and quickly seize the new opportunities for mobile library development brought by Mini Programs, actively developing mobile library WeChat Mini Programs.

5.4 Improving Promotion Models

The mobile library access guidance provided on the homepage of university digital libraries is the most direct path for users to obtain mobile library access methods. In the survey, except for Shanghai Jiao Tong University Digital Library's homepage not providing mobile library access links, the other 41 "Double First-Class" universities all provided mobile library access guidance in the form of QR codes and links on their digital library homepages, indicating that libraries attach great importance to promoting their mobile library services. However, it was also found that problems such as incomplete access guidance, unclear links, and undisplayable QR codes directly affect mobile library promotion effectiveness. For example, Nankai University Digital Library's homepage only provides mobile library access links in the form of APP clients, with other forms not prominently presented, which would make users think that only mobile library APPs are available. The actual survey found that Nankai University Library also opened a WeChat subscription account. Although Renmin University of China Digital Library's homepage provides mobile library access QR codes, it does not specify which form of mobile library it is, requiring users to scan the code to know whether it is an APP client or mobile webpage. Tianjin University's mobile library access QR code could not be displayed during the survey period. Harbin Institute of Technology Library did a better job (see Figure 8

), not only providing mobile library access QR codes on the digital library homepage but also giving clear text identification below the QR codes, enabling

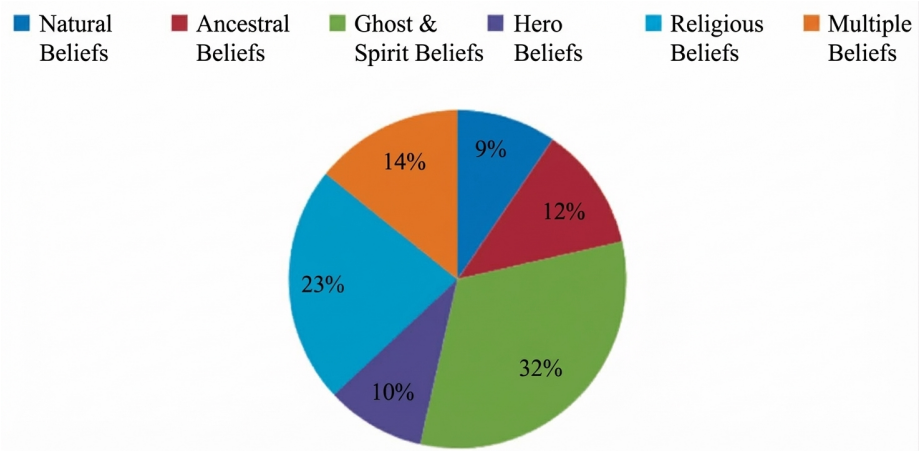

Figure 6: Figure 8

users to understand at a glance.

The relationship between mobile libraries and digital libraries is inseparable, and no library service can exist in isolation. Therefore, university libraries should pay attention to the connections between mobile platforms and portal websites, between mobile platforms, and between users and libraries, forming a complete library service system where each unit complements each other.

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Author Contributions: Xu Tiancai: Designed the overall research framework and wrote the paper; Pan Yuting: Responsible for basic data compilation and chart editing; Feng Tingting: Responsible for part of the data investigation and analysis; Yang Xinya: Responsible for partial content revision and research material provision; Wei Qunyi: Responsible for partial content revision; Yuan Hui: Responsible for final revision of partial content and verification of survey data.

The following section appears to be an advertisement for a book series and has been omitted from the main translation:

The "Expert Viewpoints" series, Volume 8, carefully planned and edited by the Library and Information Service Magazine, has been officially published. This series collects research results and wisdom from multiple experts, with novel and insightful viewpoints that reflect the status and development trends of numerous library and information science hotspots and frontier research…

Figures

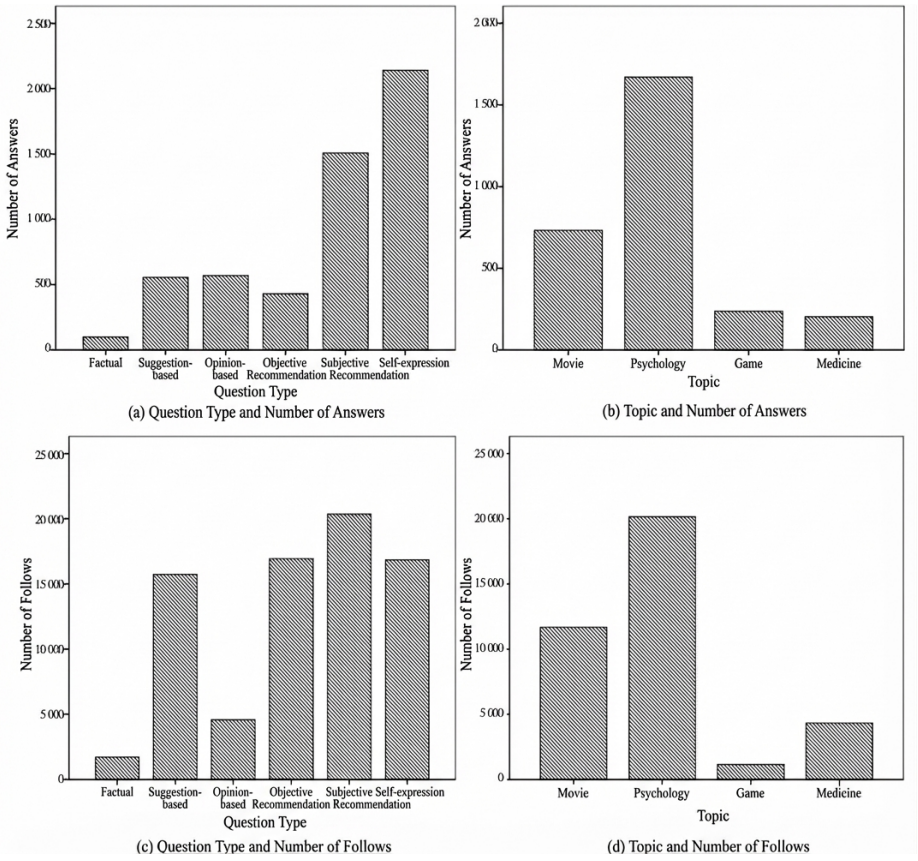

Figure 7: Figure 6

Source: ChinaXiv — Machine translation. Verify with original.

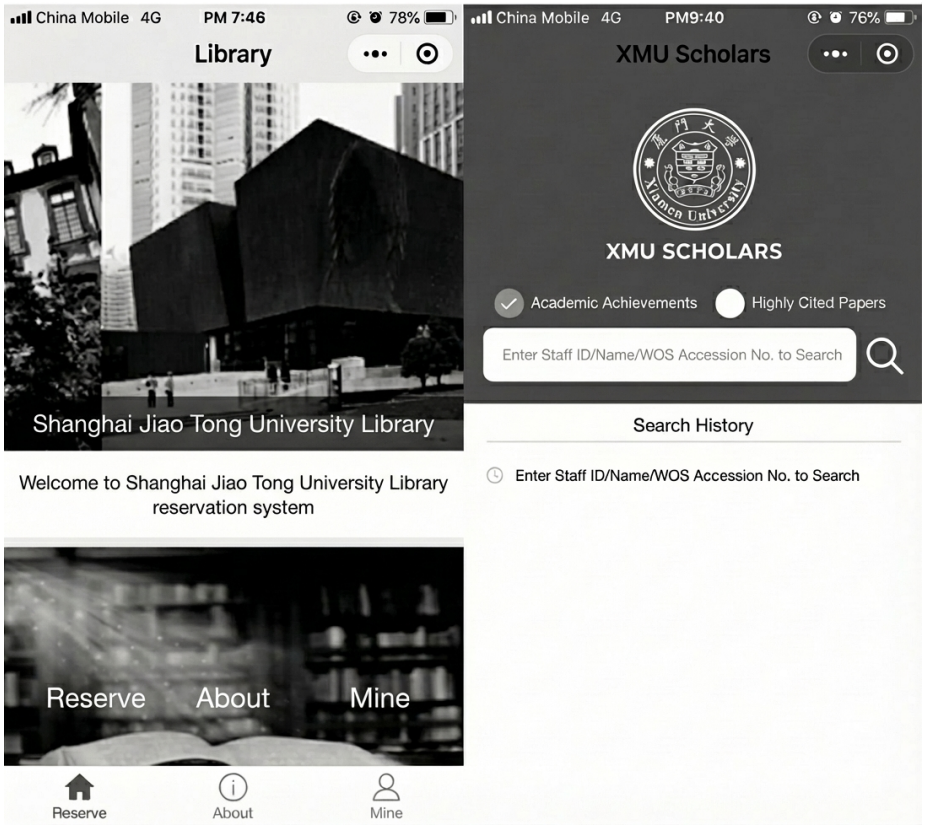

Figure 8: Figure 9