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Deepening Personalized Services in University Libraries Through Mini-Programs: A Postprint

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Abstract

[Purpose / Significance] Through a systematic review of domestic and international library personalized services and an investigation into the development of library mini-programs, this study identifies the potential of WeChat mini-programs to advance library personalized services, thereby offering a referential development direction for current library personalized service initiatives.

[Method / Process] First, the study examines the connotation, current development status, and trends of library personalized services both domestically and internationally. It then analyzes case studies of mini-program applications in library personalized services. Finally, it explores how mini-programs can facilitate the deepening of library personalized services and provides rational recommendations.

[Results / Conclusion] Mini-programs can deliver precise, targeted services to users by enhancing basic library operations, integrating existing services, and expanding new service offerings, thereby elevating the overall level of library personalized services.

Full Text

Preamble

A Research on Deepening Personalized Services in University Libraries Based on Mini Programs

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Abstract

[**Purpose/Significance**] By reviewing the development of personalized library services both domestically and internationally, alongside research on library mini programs, this study identifies the potential of WeChat mini programs

to advance library personalized services, thereby offering a reference direction for current library personalized service development. **[Method/Process]** The study first examines the meaning, current status, and trends of library personalized services worldwide, then analyzes case studies of mini program applications in library personalized services. Finally, it explores how mini programs can facilitate the deepening of library personalized services and provides reasonable recommendations. **[Result/Conclusion]** Mini programs can provide readers with precise, targeted services in three key areas: upgrading basic library operations, integrating existing services, and expanding new service offerings, thereby enhancing the overall level of library personalized services.

Keywords: mini programs; university libraries; library personalized services; applications

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1 Introduction

Mini programs are applications launched on the WeChat platform in January 2017 that can be used without downloading or installation. Since their launch, they have gained immense popularity. After several years of development, mini programs have permeated nearly every aspect of social life. Characterized by their lightweight “tap-and-use, leave-when-done” nature, mini programs have transformed many people’s application experiences. Numerous enterprises now leverage mini programs to provide more convenient and efficient services, fostering the emergence of an open and vibrant new mobile internet ecosystem.

As organizers and providers of documentary knowledge, libraries are committed to delivering more convenient information services to users. Every technological innovation in the information industry creates ripples in the library sector. Amid the mini program wave, some of libraries’ traditional service models have also undergone transformation. As mini programs encompass increasingly diverse scenarios and enable intelligent upgrades of functional services, they are poised to assume more roles in library contexts, organizing more applications and promoting upgrades in basic operations, reading promotion, book communities, reader social networking, space revitalization, commercial value, and brand development. Against this backdrop, the extension of services through mini programs can provide university library readers with better personalized services and improve the quality of documentary services.

Currently, there are growing cases of libraries utilizing mini programs for personalized services, yet systematic research on how library mini programs can promote personalized services remains scarce. This study reviews the evolution of personalized library services both domestically and internationally, enumerates

the rapid development status of library mini programs, identifies mini programs as a new highlight and important platform for advancing library personalized services, and finally analyzes the impact of library mini programs on personalized service innovation from different dimensions while offering recommendations. This research, which early on examines how mini programs promote library personalized services, holds significant practical importance.

2 Literature Review on Personalized Library Services

2.2 Development of Library Personalized Services

Library personalized services emerged around 2000 as a new service model for libraries to address readers' personalized information needs in the internet era. In October 1999, ten library experts from the Library and Information Technology Association (LITA) listed "personalized service" as the number one trend in library development. Since then, the library community worldwide has conducted extensive discussions on personalized services. Regarding the definition of library personalized services, several influential perspectives include:

American scholar E. L. Morgan provided an early definition, describing library personalized services as a user-driven, customizable information service where each user can create a private library information webpage and obtain resource lists [1]. Subsequently, the American Library Association also adopted this definition. Later, Chinese scholar Zhao Jihai argued that personalized customization service technology is a method for users to organize digital information resources according to their requirements and an important means to adapt to the diverse needs of digital library users [2]. Xia Nianjun believed that personalized information services on library websites provide targeted content and system functions based on user characteristics [3]. Zhou Qing viewed personalized services, also called customized services, as services tailored to each reader's needs... The services provided are no longer one-size-fits-all but rather cater to individual needs, ensuring everyone gets what they require [4]. After analyzing definitions of library personalized services both domestically and internationally, Luo Chunrong and Ma Lixia concluded that library personalized services refer to integrated information services in the digital information environment where libraries, primarily using networks and information technology, acquire and analyze users' information usage habits, preferences, backgrounds, and requirements to fully satisfy their individual information needs [5].

As evident above, different scholars approach the definition from various angles, and academia has yet to reach a unified conclusion. Broadly speaking, all definitions revolve around the idea that library service models are increasingly capable of guaranteeing users' personalized needs amid technological changes. This study posits that library personalized services are information services with strong directionality and diversity that libraries provide to readers based on user needs and technological advancement. Specifically, this research refers to how lightweight and diverse library mini programs can better provide readers with

multi-level personalized information services.

After more than a decade of development, library personalized services have witnessed new developments and changes in three aspects: library service models, technological transformation and application, and user information mining and push.

2.2.1 Library Service Models Early foreign research emphasized a library personalized service model that balanced technological advancement with humanistic promotion, later accepting and utilizing technological updates to return to a people-oriented boutique service model. For example, around 2000, scholars emphasized that personalized services should not neglect human services amid various technological impacts, facing the intervention of internet information in library personalized services. Scholars S. B. Archer and M. Cast stressed the importance of maintaining personalized connections in library services, emphasizing both human contact and technological innovation [6]. Similarly, St. Edward's University in Texas proposed a humanized communication model—maintaining communication between librarians and readers under the premise of machine-based personalized services [7]. With the development and iteration of computer technology, people began to realize that regardless of what technology drives the development of library personalized services, the core of service should return to reader needs. Providing quality services centered on readers using technology became the more desirable model. Therefore, after 2010, the boutique model of library personalized services received increasing attention from scholars. This model emphasizes precise control of reader needs and collaboration between librarians and technology. Australian scholar W. Frerichs proposed that a user-centered boutique approach is the model for libraries to cope with current difficulties, arguing that library services can utilize a “boutique method” to address rapid global technological changes, tightened budgets, and high user expectations [8]. British Cambridge scholar E. Tilley even argued that personalized boutique services are critical to the success of academic libraries [9].

Domestic scholars focus more on library information flow patterns and specific business implementation models. Du Yanjie and Lü Jianxin divided service models into three aspects: user customization services, library active push services, and library-user interaction [10]; Feng Xinmin believed that personalized services in China's university mobile digital libraries can be categorized into five approaches: reservation service models, information retrieval personalization models, project assistance service models, remote education course service models, and establishing personal webpages for university instructors and academic leaders [11].

From the perspective of library personalized service models both domestically and internationally, whether emphasizing meeting user needs abroad or implementing various forms domestically, all approaches ultimately focus on technology development centered on user needs.

2.2.2 Technological Transformation and Application Foreign research is more specific, leaning toward the application of a specific framework or technology. Taking the leading Web-level service framework as an example, “MyLibrary” initiated by Cornell University Library and subsequently adopted by various universities represents the best service framework in the early stage of library personalized services [12]. Community construction for book resource services based on MyLibrary [13] and various forms of internet reading community construction (such as “Introduction to Bookworm” maintained by Yale University Library’s Digital Humanities Lab and “Building Bookworm” created by Harvard’s Cultural Observatory) [14] all emerged based on the MyLibrary framework and its derivative social frameworks.

Additionally, foreign research pays close attention to the impact of mobile communication technology on library personalized services, such as studying content services from different publishers on mobile devices [15] and launching wireless personalized information services for wireless electronic devices (like BlackBerry and PDA) [16].

Domestic scholars’ research is relatively macroscopic, covering the influence and promotion of internet technology development on library personalized services over the past decade. Du Yanjie and Lü Jianxin believe that technologies affecting library personalized services include: (1) supporting technologies such as data push technology, intelligent search engine technology, dynamic webpage generation technology, intelligent agent technology, data mining technology, information filtering technology, Web database technology, data encryption technology, portal technology process, process tracking technology, secure identity authentication technology, and intelligent search engine technology; (2) Web 2.0 technologies such as Blog, Podcast, Wiki, RSS, Tag, and SNS, which emphasize user participation and experience; (3) cloud computing, which involves using related technologies to reorganize and integrate library resource equipment and applying it to promote the realization of library service concepts [10].

Zhao Wenjia summarized that personalized service development mainly involves Web data mining and modeling [17]. Technologies from various internet eras have been applied in the library field. In recent years, scholars have focused on deepening library personalized services oriented toward big data, such as Liu Haiou et al.’s “Research on Contextual Recommendation Systems for Mobile Digital Libraries Oriented to Big Data” [18] and Zhang Junben’s “Research on Library Personalized Push Systems Based on Big Data” [19]. Notably, as the WeChat platform has become the first choice for more and more people’s communication, WeChat-based library personalized services have also become a focus of research and practice in recent years, such as Chen Jinbo’s “Research on Library Information Resource Push Based on WeChat” [20], Guo Jun’s “Investigation and Analysis of the Service Status of ‘985’ University Libraries Based on WeChat Public Platforms” [21], and Peng Chunlin’s “Application of WeChat in Public Library Information Services” [22].

Domestic and foreign scholars have explored technology from different angles,

but both have conducted explorations in two major directions: PC-side internet services and mobile communication device services, with various personalized customization services on the mobile side gradually receiving attention.

2.2.3 User Information Mining The starting point and foothold of library personalized services have always been user needs. In terms of business, whether in the development of subject librarian services or various technologies for mining user needs, user needs have always been the core of service and the direction of technological mining. Foreign scholars focus on several aspects: information mining and utilization under the big data background, such as information mining and text processing technology applications under big data [23]; school business integration driven by personalized services, such as the design of mechanisms linking scholarships with library business [24]; and literature data purchasing practices driven by big data, such as the University Library at the University of Illinois at Urbana-Champaign establishing a data purchasing program in 2010 to provide funding for purchasing databases requested by students and faculty and making these data available to the entire campus for future use [25].

In domestic research, Du Yanjie and Lü Jianxin believe that from 2000-2012, the satisfaction of user needs was mainly reflected in the development of digital reference consultation [10]. In recent years, user data mining has become increasingly detailed. Chen Dan proposed applying machine learning and other intelligent technologies to analyze and mine user big data, construct user portraits, and associate users with resources through user portraits to provide personalized intelligent services for users [26]. On October 24-25, 2018, Peking University Library held the “International Academic Symposium on User-Oriented Information Services to Commemorate the 120th Anniversary of Peking University Library” [27], identifying user orientation as the greatest development direction for library personalized services.

As evident above, scholars both domestically and internationally attach great importance to user information mining under big data. Foreign research combines data analysis with specific campus services, making it more practical; domestic research started later, initially focusing on manual reference consultation, but in recent years, analysis and mining under the big data background have gradually received attention.

2.3 Trends in Library Personalized Services

From the above developments, it is clear that library personalized services have evolved alongside internet technology, with each technological innovation promoting their advancement. University libraries both domestically and internationally have seen their service models change and service content continuously develop and upgrade under the support of different technologies. Recent hotspots in library personalized services include data analysis and mining under the big data background and the promotion of library personalized services

by WeChat. Libraries have invested heavily in new technologies for user needs analysis. The development of library personalized services should be based on reader needs while developing mobile user data mining and targeted services. Li Yan pointed out that the “big data + micro-services” model for university library personalized services represents the future development trend [28].

Mini programs naturally embed within users’ WeChat, meeting the requirements of mobile services for anytime, anywhere access. WeChat’s strong user base and data integration and presentation capabilities also enable library mini programs to maximize their proximity to reader needs. With good data mining and service design, mini programs have the capacity to meet more personalized reader needs. Simultaneously, mini programs are also the best combination point for university big data and micro-services, aligning with the development trends and requirements of library personalized services in this era.

3 Types and Cases of Mini Programs Enhancing Library Personalized Services

3.1 Innovation Types of Mini Programs Enhancing Library Personalized Services

From the above research, it is evident that library personalized services have benefited from technological development and progress from their inception. As a newly emerged powerful technology, the impact of mini programs on library personalized services at the current stage can be revealed using Hua Bolin’s “Correspondence Between Knowledge Gene Theory and Innovation Levels” [29]. Hua Bolin believes that knowledge genes not only have genetic inheritance but also exhibit innovation characteristics: “gene mutation corresponds to disruptive innovation of knowledge, i.e., original innovation; gene recombination corresponds to integrated innovation of knowledge; gene evolution corresponds to introduced, digested, absorbed, and re-innovated knowledge (improved innovation)” [29].

Within this framework, the mini program technology acts as a catalyst for the knowledge gene of library personalized services. In the practice of knowledge gene innovation, cases generated by library personalized services can be divided into three levels: improved innovation, integrated innovation, and original innovation. The emergence of mini programs upgrades the existing personalized service platform of libraries, representing improved innovation; mini programs integrating original content of library personalized services and providing new services represent integrated innovation; the emergence of unprecedented areas of library personalized services on the mini program platform represents original innovation. All three forms of innovation can greatly improve the level of library personalized services in different aspects.

3.2 Improved Innovation Cases The WeChat platform already provides portable services for most library businesses. In recent years, WeChat’s role in mobile library practice has been evident, with most libraries opening WeChat

public accounts to serve readers. Wang Di's "Investigation and Analysis of WeChat Public Platforms of 48 Undergraduate University Libraries in Jiangsu Province" shows that collection inquiry is the most common function, with 44 out of 48 public accounts (92%) featuring it; 40 have reader card binding/unbinding functions (83%); 39 have borrowing/renewal functions (81%); 38 have announcement/lecture training and new book/popular book functions each (79%). Additionally, common basic service functions include FAQ/contact us, freshman columns, seat reservation/self-service printing, activity zones, and reader recommendations [30]. Furthermore, Zhang Qian's "Analysis of the Impact of 'Micro-Services' on Reading Promotion Effectiveness" argues that micro-services effectively enhance student attention to libraries [31]. Zhao Fazhen's "Differences, Complementarity, and Integration of University Library Mobile Service Platforms" indicates that libraries operate different types of mobile service platforms differently, mainly focusing on WeChat operation, with Weibo activity declining, QQ only used for user consultation, and APPs basically operated by other developers [32]. Chen Dongling's "Analysis of WeChat Public Platform Operation Effects of University Libraries Based on SPSS" points out that in June 2018, the average influence value of WeChat public platforms of "985" university libraries was 366.12, with 18 university library WeChat public platforms exceeding the average, indicating a rising trend in influence levels [33].

In summary, basic library businesses such as collection inquiry, personal user login and renewal, arrival reminders, online reading, online courses, information release and activity promotion, reference consultation, and VR experience can almost all be provided by WeChat public accounts. From a development trend perspective, library services on the WeChat end are generally on the rise and can enhance the effectiveness of library business services.

Mini programs continue WeChat's advantages and represent a new window for enhancing library personalized services. As more and more public accounts bind with mini programs, many libraries have also opened mini program services. Yan Dong's "Analysis of the Current Status of Library WeChat Mini Program Usage in China" summarizes [34]: mini programs can play roles in "reading promotion, space reservation and seat systems, book search, activity display, communication, and games" in library application scenarios. Thus, except for the gaming function, most mini program functions represent improved innovation of existing business platforms, while a few integrated mini programs with various businesses exhibit integrated innovation characteristics.

Existing examples include the inBooks mini program developed by Shanghai Library based on its rich collection resources and digital humanities practice. This tool integrates the library's resources with targeted mini program services, allowing readers to obtain corresponding digital resources by taking photos of books with their mobile phones while building personalized knowledge networks to help readers form knowledge systems [35]. Additionally, Zhu Yuqiang utilized mini program shelf-arrangement games to gamify and simplify library business training, using WeChat's official Web developer tools to design and implement

a call number arrangement game to enhance the entertainment value of library user training and explore the application prospects of WeChat mini programs in library mobile services [36]. Zhu Yuqiang also used a book drifting mini program to solve problems such as books in drift being unable to be borrowed [37].

Furthermore, the library of Nanjing Drum Tower Hospital utilized mini programs for user information analysis, combining library information services with mini programs to process large amounts of library-generated information and apply it to services [38]. Yin Mingzhang et al. discussed an “O2O Book Sharing Platform for Universities Based on WeChat Mini Programs” [39], applying social book sharing cases to the university level to develop a university O2O book sharing platform, achieving green cultural services for book sharing. Lu Xiaohong also elaborated on library mini program O2O and social sharing to assist book services [40]. On April 23, 2019, the Chengdu Documentation and Information Center of the Chinese Academy of Sciences and a Guangzhou biological research institute jointly developed and released the “Stem Cell Research Assistant” WeChat APP for trial operation, integrating scientific research information browsing, intelligent retrieval, and personalized services in the field of stem cell knowledge discovery—a typical case of vertical deepening of literature resource services in specific disciplines.

3.3 Original Innovation of Mini Programs Promoting Library Personalized Services After libraries introduced mini programs, unprecedented forms of personalized business have emerged. For example, the libraries of East China Normal University and the Agricultural Information Institute of the Chinese Academy of Agricultural Sciences mainly provide study room reservation services, the Hunan Police Vocational College Library mini program offers a message BBS function, and the Harbin Institute of Technology Weihai Campus mini program provides CET-4/6 score inquiry and course query functions. University library mini programs have added personalized services such as seat selection and research room selection, while also accommodating cross-departmental student services like course selection and grade inquiry from academic systems.

Library personalized services using the mini program platform have demonstrated unprecedented original businesses. Some libraries have developed distinctive and targeted new precision services based on their technological and resource advantages. The above examples are cases where mini programs break through existing service models and deepen library personalized services in terms of original innovation. In the library field, the momentum of mini programs creating new service growth points is gradually emerging. However, research shows that the role of mini programs in university libraries is not yet significant. According to relevant data [34], there are 2,914 universities and 3,153 public libraries in China, but only 19 libraries have opened WeChat mini programs in this survey, accounting for just 0.31% of the total, indicating an extremely low application rate of WeChat mini programs in libraries. Univer-

sity libraries should increase their emphasis on mini programs, strengthen the development of their unlimited possibilities, and enhance resource services from multiple dimensions.

4 Practical Recommendations for Extending University Library Personalized Services Through Mini Programs

Mini program practices demonstrate that they extend library personalized services across three innovation types: in improved innovation, mini programs have good momentum in intervening in library business development, and the next step can continue to promote the mobility and portability of businesses; in integrated innovation, mini programs somewhat help with library resource integration, and the next step can utilize mini programs to integrate various resources and provide multi-level, multi-themed mobile resource integration platforms; in original innovation, there are already unprecedented precedents, and the next step can utilize mini programs for business innovation in different dimensions such as reader segmentation, demand refinement, and functional differentiation.

4.1 Utilizing Mini Programs to Continue Mobilizing Existing Businesses and Create More Portable Personalized Service Platforms

From existing library mini program cases, mobilizing original businesses is the most common practice when mini programs enter the library personalized service field. In future library mini program development, university libraries can continue to utilize the platform advantages of mini programs to promote more original business mobilization. Meanwhile, mini programs can also improve existing mobile services and provide more convenient and user-friendly service experiences.

For example, introducing mini program mobile services in reference consultation and literature retrieval courses can promote the portability of these businesses, improve consultation efficiency, and enhance teaching effectiveness. Mini programs can provide portable literature retrieval courses and consultation services. University libraries offer literature retrieval courses in various forms, including public courses, MOOC online classrooms, and WeChat public accounts. In the mini program era, library lectures and retrieval courses can also be provided separately or through live streaming platforms. Mini program-based consultation services and literature retrieval courses have the advantages of simplicity, portability, and strong interactivity. Librarians can provide targeted intelligent responses on mini programs, optimizing the workflow of consultation departments to better provide targeted services for readers.

Additionally, book review sharing in traditional web-based “My Library” and academic social activities such as library reading clubs can integrate functions through mini programs to amplify and unite reader communities, enhancing personalized academic social functions. Traditional libraries conduct reader surveys and voting through official websites or offline methods, which is labor-intensive,

has long cycles, and poor interactivity. Now, through mini programs, online voting among reader groups can be implemented with real-time results, accelerating survey efficiency. By setting up specific mini programs to gather students with similar interests within the library's campus network for targeted resource push, libraries can both strengthen the promotion of activity resources and leverage WeChat's convenient login advantages to expand communities. More specifically, logging into the local OPAC through WeChat mini programs enables real-time comments, avoiding the previous awkwardness of having to log into Weibo or Douban to evaluate OPAC books. Readers can also enhance library online social functions through book reviews, voting on matters, and reading promotion activities. Against the backdrop of increasing electronic resources and relatively declining library visits, this can consolidate the library's campus social attributes and feed back into social-based reading promotion, reading clubs, and reading group activities to expand library influence and brand image.

Moreover, mini program platforms can optimize the user experience of already mobilized library businesses, solving the problems of space occupation and functional overlap caused by similar APPs, and providing friendlier and more lightweight upgrade services. For example, mini programs can reduce the burden on readers' phones from existing mobile personalized service APPs. Readers currently commonly use multiple library-related APPs: mobile library APPs, mobile course selection APPs, reading APPs, CNKI Global Academic Express, Xuexitong, etc., each requiring downloads that occupy phone space and data. To achieve mobile access to literature resources, readers need to constantly switch between these APPs. The space-saving attribute of mini programs can provide more convenient and traceless access modes, undoubtedly liberating readers. University students face a complex reading environment where literature, e-books, and digital resources are not in one system. Mini programs have the advantages of being ready-to-use and space-saving, and unlike public accounts that constantly push unwanted information, they can reduce the occupation of users' attention, serving as a temporary solution to improve library user experience.

4.2 Utilizing Mini Programs to Build Literature Resource Data Platforms and Integrate Literature Resources Across Different Fields

University libraries can use mini programs to provide integrated services for building various resource discovery platforms. For example, a mini program version of a university literature resource unified discovery platform allows readers to complete the entire process of cross-database retrieval, mobile storage, anytime reading, and social sharing by simply entering keywords on the WeChat end. Massive literature integration retrieval combined with WeChat's social attributes enables mini program technology to provide more powerful mobile resource discovery and integration platforms for university libraries.

Existing examples include the inBooks mini program tool developed by Shanghai Library mentioned above. Other suitable mini program tools include small

plugins like Kopernio from Clarivate Analytics, an integrated retrieval tool for tracking full-text literature across the web. If mini program-ized, it would transform researchers' daily literature search scenarios from computer-only to mobile, adding better usage experiences such as quick sharing and ready-to-use convenience.

Additionally, university libraries can integrate OA resources into a mini program platform. Different universities have different strong disciplines and varying resource construction funds, inevitably leading to biased considerations in data resource allocation and usage. In this context, how to make good use of OA resources on the internet through reasonable screening, integration, and presentation is also a direction for library work. The intervention of mini programs provides a platform for library OA resource integration. By integrating academic resources from OA platforms such as PMC (PubMed Central), OALib (Open Access Library), and DOAJ (Directory of Open Access Journals), libraries can reasonably supplement gaps in their resource construction. Unlike traditional databases restricted by IP and accounts, OA resources have open-source advantages in resource integration, sharing, acquisition, and dissemination. Different universities can fully utilize this feature to integrate needed OA resources, establish mini program platforms, achieve integration of open data and portability of resource acquisition, thereby assisting teaching and research.

Mini programs can also integrate university characteristic and advantageous literature resources to assist digital humanities practice. In recent years, digital humanities projects in libraries have been very popular, focusing mainly on knowledge graphs, data analysis, visualization, and GIS. However, the technologies facilitating digital humanities in literature and history disciplines vary by institution. Text analysis, knowledge graph depiction based on certain data, data analysis models, and GIS-based spatial navigation technologies have not yet matured into market-dominating products. Therefore, at the current stage, developing inclusive analysis and presentation tools through mini programs to provide corresponding services for scholars could be a direction for library digital humanities mini program development. At the GIS technology level, library space navigation is also a practical technology to help readers quickly locate needed resources. In libraries, many universities have begun using GIS positioning systems and RFID systems to locate resources and provide navigation services. Libraries can develop library guidance mini programs to direct readers in finding reading rooms, book and newspaper areas, and even refine to the collection locations of target paper resources. Additionally, mini programs have a "nearby mini programs" function, allowing readers unfamiliar with library buildings to directly find library navigation through mini programs when needing guidance to locate resources. This can improve the experience of resource navigation services, make library services more accessible anytime and anywhere, and more precisely meet reader needs while being ready-to-use, avoiding further occupation of readers' phone space.

4.3 Utilizing Mini Programs to Segment Reader Needs and Provide Innovative Services for Different Requirements

Traditional university library websites or WeChat public accounts tend to emphasize traditional resources and services, often presenting various resources and services mixed together, requiring readers with different needs to search for resources step by step based on their judgment. In the mini program era, university libraries can fully utilize the diversity and lightweight nature of mini programs to segment reader groups, segment reader needs, provide more targeted and innovative new services, and cater to every need comprehensively.

- (1) Mini programs can distinguish reader groups and provide platforms for innovative personalized services for specific groups in characteristic colleges. China's universities are numerous, each with its own characteristics, and there are different reader groups within schools. Both situations require segmented and segmented characteristic personalized services. Under the premise that basic businesses such as library acquisition, cataloging, and reading are basically consistent, developing personalized businesses and characteristic resource construction based on the school's features is the focus of each library's work. Mini programs can provide platforms and possibilities for personalized services in such institutions. For example, ethnic minority institutions can develop and promote specific ethnic script image recognition, ethnic script text analysis, and ethnic script translation mini programs. Through readers' mastery of ethnic languages and understanding of technology, they can develop ethnic version mini programs suitable for their library to provide targeted services; law and political science institutions' students generally struggle with familiarizing and memorizing legal provisions, and libraries can develop rapid query and citation systems for legal provisions on mini program platforms for quick use by teachers and students; finance and economics institutions can provide commonly used mathematical analysis tools to help teachers and students practice basic algorithms on the go. Such original mini programs can truly meet reader needs.
- (2) Mini programs can segment scenarios and needs within libraries, provide innovative application services, and promote university library space revitalization. Readers' activities in libraries mainly involve obtaining literature resources and text creation. In text creation, the most commonly used technologies are basic data processing technologies such as format editing, text analysis, image recognition, and OCR word extraction, as well as thesis processing tools like Endnote and NoteExpress. However, mobile possibilities are numerous, and these technologies themselves can become technical services provided by libraries. University libraries can purchase such text processing mini programs to create more detailed text technical services for readers. In practice, image-to-text conversion tools can be positioned in the library, or their QR codes can be promoted within the library. Libraries can promote text and image recognition assistants,

text translation, text analysis, image processing, AI voice assistants, voice input, voice query, text analysis, and other auxiliary tools and tutorials in reading or study areas to facilitate readers' research and writing in the library. The openness of mini programs makes libraries more tool-oriented and increases user stickiness.

- (3) Mini programs can reshape library roles and connect originally non-existent businesses. For example, adding entrepreneurship incubation businesses based on reader needs. Traditional libraries provide solutions for literature resources, but in the mini program era, libraries can become technology intermediaries, providing platforms to incubate mini programs that meet different reader needs. For instance, encouraging students to write text format and image processing mini programs based on reader needs, allowing them to deeply participate in constructing personalized service models based on their own needs. In specific operations, university libraries can collaborate with school career guidance centers to launch collection activities for image editing mini programs, encouraging and promoting student technological entrepreneurship. If product quality is sufficient, university libraries can also promote student-developed mini programs through their own influence, providing entrepreneurship platforms for students. In this scenario, university libraries can both fully exert initiative to provide readers with more diverse and thoughtful detailed services and expand their functions, changing from traditional space provision to having incubator functions, encouraging and promoting student entrepreneurship practices, and focusing on project implementation. In terms of proposing, promoting, and using original mini programs, libraries can reinvent businesses and create more value.
- (4) Mini programs can make university libraries more humanistic and become part of the overall campus culture packaging. For example, university libraries can become inheritors, packagers, disseminators, and leaders of campus culture. In 2018, the Palace Museum's cultural and creative product sales reached 1.5 billion yuan, with culturally rich products showing new vitality. University libraries have their own characteristic collections and are important cultural symbols of their schools. Attempting cultural and creative design and commercialization, mini programs can become online platforms for cultural and creative display and sales. Mini program commerce differs from traditional commercial advertising's large-scale promotion by providing online sales services for cultural and creative products when students search or scan QR codes when needed, neither disturbing readers nor discovering cultural and creative needs. This service can also promote the development of university library brand culture.

5 Conclusion

Mini programs not only meet the trends of library personalized development and provide readers with personalized services to the maximum extent but also

adapt to the current network and social context, representing the most potential technological platform for deepening university library personalized services. Library personalized services can leverage the influence of mini programs to enable more readers to obtain tailored information services from the above aspects. With the arrival of 5G networks, “the transformative impact brought by 5G’s core processing object being ‘data’ means that in the 5G era, the core resources of library information dissemination will further shift from content and channels to data, and will realize the transformation of ‘data’ value through multiple services and application scenarios” [41]. Mobile phones will bear larger-scale data flow and interaction, and the lightweight advantage of mini programs’ ready-to-use nature will be further presented. The lightweight and portable services of library mini programs will inevitably be the direction for deepening and upgrading library personalized services. In the general trend of ubiquitous information services, mini programs will certainly occupy an important position in new university library services.

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