# Spatial Function Design and Service Innovation of New University Library Buildings: A Case Study of the New Library at Taiyuan Normal University (Postprint)

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## Abstract

[Purpose/Significance] This study analyzes and discusses the objectives and directions of new university library construction, explores the spatial design and functional characteristics of university libraries in the new environment, and provides references for the construction of new university libraries and space renovation. [Method/Process] Taking the new library of Taiyuan Normal University as an example, this research employs case analysis and questionnaire survey methods to analyze the current status of new university library construction, investigate readers' opinions and satisfaction levels regarding new library construction, and examine problems in construction concepts, layout, and services while proposing considerations. [Result/Conclusion] University libraries should take physical space as the foundation, information resources as the support, new technologies as the means, and service innovation as the guarantee to promote sustainable development and transformational reform of university libraries.

## Full Text

## Preamble

**Spatial Function Design and Service Innovation in New University Library Buildings: A Case Study of Taiyuan Normal University's New Library**

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**Abstract:** [Purpose/Significance] This paper analyzes the objectives and direction of new university library construction, explores spatial design and func-

tional characteristics under new environmental conditions, and provides reference for new library construction and space reengineering in university libraries. [Method/Process] Taking the new library of Taiyuan Normal University as a case study, this paper employs case analysis and questionnaire survey methods to examine the current state of new university library construction, investigate reader opinions and satisfaction levels regarding new library development, and identify issues in construction concepts, layout, and services while proposing reflective solutions. [Result/Conclusion] University libraries should promote sustainable development and transformational change by taking physical space as the foundation, information resources as the basis, new technologies as the means, and service innovation as the guarantee.

**Keywords:** university library; spatial function; service innovation; transformation

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With the rapid development of higher education and new technologies represented by artificial intelligence, university libraries have entered a new period of development opportunities. The "Double First-Class" university construction initiative has placed new demands on continuous new library development. New library construction faces not merely the challenge of physical library architecture, but more importantly, the reengineering of library spatial functions and spatial services, carrying the mission of transforming from traditional libraries to new-generation libraries. The experience of Taiyuan Normal University's new library construction demonstrates that spatial function design and spatial service development are the key issues directly confronted during and after new library construction. University libraries should seize the opportunity of new library construction, adhere to people-oriented and sustainable development concepts, strengthen the construction of new functional spaces, continuously innovate services, and promote sustainable development and transformational change.

## 2 Background and Related Research on New University Library Construction in China

### 2.1 Background of New University Library Construction in China

Since the expansion and merger of universities at the turn of the century, Chinese university libraries have experienced a boom in new construction, expansion, and renovation alongside the growth of higher education. By 2005, with the continuous expansion of university enrollment, the rise of higher education parks and university towns across the country further intensified new library construction, primarily manifested as expansion in volume and scale. However, with the rapid development of new media and technologies, the IFLA Satellite Meeting held in Turin, Italy in 2009 proposed two concepts—"the library as

place and space" and "the library as third space"—marking that postmodern "spatial turn" thinking had begun to substantially influence library spatial concepts and architectural design philosophy. Subsequently, the domestic library community has continuously explored and practiced transformations in library spatial design, functional layout, and services. In 2015, the State Council issued the "Overall Plan for Coordinating the Construction of World-Class Universities and First-Class Disciplines." Against this backdrop of Double First-Class construction and driven by new technologies represented by artificial intelligence and the Internet of Things, smart library construction has become an inevitable trend. In 2016, Wu Jianzhong proposed the concept of the "third-generation library," arguing that it requires further spatial reengineering and functional optimization. The opening of Fudan University Library's Medical Branch in 2017 transformed the library into a space that adapts to multiple application scenarios, attracts diverse users, and achieves composite service functions, representing the development direction of "third-generation libraries."

In summary, new university library construction in China exhibits three main characteristics: First, it is closely related to the development of higher education; second, it is driven by the revolution of new media and technologies; and third, it has gradually shifted from volume and scale expansion toward spatial function design, sustainable development, and intelligent direction.

### 2.2 Related Research on New University Library Construction in China

On January 6, 2019, the author conducted a literature search in CNKI using the strategy "TI='university library' AND KY='new library construction' OR 'branch library construction,' " retrieving 49 records. After intensive study of these research documents from 2000-2018, the research background, publication characteristics, and features were compiled as shown in .

The analysis of 12 representative research documents from 2015-2018 on new university library construction reveals several conclusions: First, the focus has shifted from element construction to connotation construction, with recent research paying close attention to spatial function design and space reengineering. For instance, scholar Chen Wei advocated reconstructing service functions and spatial layout based on the concept of building a "leisure and cultural center, knowledge sharing center, and exchange and interaction center." Guo Ha noted that to meet modern usage requirements, new library layouts present a diversified and convenient functional pattern. Guo Jun argued that new library functional layout should follow the principles of "convenience for readers" and "separation of dynamic and static areas." Shen Qingqing and colleagues explored the basic content and key issues of transforming old university libraries into information commons, recommending reforms in physical space, virtual space, and support mechanisms from three levels. While these studies have contributed to new library construction and sustainable development and laid foundations for future exploration, research on spatial function layout design remains insuf-

ficiently comprehensive. Second, scholars have examined the people-oriented construction concept from different perspectives. Cai Hong argued that the contradiction between library supply and reader demand is the primary contradiction in new library construction, which should be people-oriented and centered on student needs. Cheng Yuqin and colleagues emphasized that in collaborative innovation environments, new library function design should be people-oriented, creating environments that attract readers to better utilize information resources and meet personalized services. Li Yulong and Zhang Guoguo proposed that humanistic space should be a people-oriented, accessible, green, and sustainable cultural-spatial combination. Xiao Lin proposed the principle of "adhering to reader-centered design" for learning commons in new library construction. Building upon these previous studies and combining Taiyuan Normal University's positioning and new library characteristics, this research provides a comprehensive study of spatial function design for new university libraries, elaborating on construction concepts of people-orientation, sustainable development, and intelligent construction from the perspective of spatial function design. This distinctive spatial function design lays a solid foundation for service innovation in university libraries.

## 3 Construction Concepts and Spatial Function Design of Taiyuan Normal University's New Library

Through the joint efforts of the university and library stakeholders, Taiyuan Normal University's new library opened on October 20, 2018. The new construction expanded physical space, enriched information resources, met the diversified needs of different reader groups, and provided various activity spaces for learning, research, exchange, interaction, and innovation. It has become a cultural sharing center integrating physical shared space, information resource space, learning and research space, and interactive experience space, achieving transformational change from traditional to modern library in spatial function design. Within just a few months of opening, it was reported by Shanxi Satellite TV, Yellow River TV, and Taiyuan TV, and covered by numerous online media including Toutiao, Yellow River Headlines, China Daily, Sohu, Sina, NetEase, and Tencent, earning the reputation of a "internet-famous library."

### 3.1 Establishing a People-Oriented Library Construction Concept

"People-oriented" is the core of humanistic management, treating people as the fundamental element, stimulating creativity based on respect, fully mobilizing human initiative, and achieving people-centered management for comprehensive human development. University library construction should establish a people-oriented concept, being staff-centered internally and reader-centered externally. Taiyuan Normal University Library has integrated this people-oriented thinking into environmental design, functional layout, and modern service management, reflecting new concepts and thinking for modern library sustainable development.

**3.1.1 Humanistic Environmental Construction and Spatial Function Design** Taiyuan Normal University is a full-time undergraduate institution focusing on teacher education, where students are both current learners and future educators. The university must establish a people-oriented educational philosophy. The new library construction combines humanity with space, permeating humanistic design concepts into each functional zone to create a beautiful, fully functional, and culturally rich space that better adapts to the times and meets reader needs, allowing the library to radiate endless vitality under the new era's sunshine. First, the main building adopts a three-unified, large-space structure and design: unified floor height, unified column grid specifications, and unified load capacity. This integrated and flexible layout of collection, lending, reading, and consultation creates a warm reading atmosphere of "people among books, books among people," enabling readers to switch freely between being learners and future educators. Second, to adapt to new technology development and the needs of Double First-Class construction, Taiyuan Normal University Library draws on the successful experience of Fudan University Medical Library's spatial function design, creating diversified learning commons for different reader levels and research needs. The project research rooms on the top floor are the most distinctive feature, equipped with desks with lamps, chairs, computers, wireless internet, printing and scanning equipment, as well as bookshelves and various literature resources including books, journals, and audio-visual materials matched to research projects, facilitating project research. According to disciplinary characteristics of research projects, the library also personalized and flexibly decorated research spaces, particularly utilizing corner spaces to create unique cozy stations—small indoor and outdoor spaces for research users featuring coffee bars and tea breaks, allowing them to exchange ideas or adjust thinking after intensive mental work, meeting deep learning and research needs and improving research efficiency and output quality. These diversified spaces are filled with humanistic care, transforming the library from a single physical space into a truly unified interpersonal communication space integrating material and spiritual, subject and object, abstract and concrete, real and imaginary elements.

**3.1.2 Creating a Warm, Harmonious, and Positive Humanistic Environment** The people-oriented construction concept continues to sublimate in practice, with traditional element construction no longer the focus. Instead, creating a warm, harmonious, and positive humanistic environment receives increasing emphasis. Upon entering the library, clear and eye-catching signage guides you anywhere you want to go. Corridors and some walls display famous quotes and learning mottos to encourage readers. The main service desk and various departments have reader feedback books. Moreover, the library engages students in construction and management through work-study programs and other activities, achieving the implicit educational effect of "the peach and plum trees do not speak, yet a path forms beneath them." This positive humanistic environment strengthens the educational function of university libraries. Zhejiang

University Library also emphasizes humanistic environment construction as an important component of humanistic design, particularly focusing on integrating the artistry of humanistic design material carriers with reader participation to standardize and guide reader behavior.

**3.1.3 Innovating People-Oriented Diversified Spatial Service Models**
Space is the carrier of services, and service is the lifeblood of space. Taiyuan Normal University Library's new construction firmly grasps this service lifeline, innovating people-oriented diversified spatial service models. First, it closely integrates RFID technology with computer technology, introducing self-service equipment to provide autonomous services. This significantly saves library manpower and service time while properly managing resources and innovating service items. On one hand, it enhances reader freedom and increases collection circulation; on the other hand, it liberates librarians from monotonous, repetitive, and tedious work, shifting their focus to deeper personalized services while alleviating staffing shortages in university libraries. Second, it strengthens the cultivation of subject librarians to provide personalized customized services and embedded services for research readers and university teaching and research. This not only improves the quality and efficiency of university teaching and research, reflecting the core value of university libraries in serving teaching and research, but also enables librarians to learn through practice and achieve self-improvement and spiritual growth.

### 3.2 Upholding the Concept of Sustainable Development

New library construction is a comprehensive, cross-disciplinary, and cross-domain undertaking. In terms of building scale, consideration must be given to whether it can still meet needs five or ten years later. In architectural design, an appropriate balance must be found: First, spatial function design should have usage flexibility, meeting current needs while accommodating future development requirements as much as possible. The design should consider that the same space can serve multiple purposes such as collection storage or reading, enabling functional adjustment without changing building structures. Second, functional layout should have extensibility. On one hand, based on the principle of "the Great Expansion has fifty, but only forty-nine are used," each floor's physical space can be relatively arbitrarily divided while leaving room for future functional development. On the other hand, it manifests in scalability through large-space forms integrating collection, lending, and reading, allowing flexible adjustment of open-shelf areas and reading areas according to literature structure and user needs, with anticipatory measures to meet user needs for information access and knowledge exploration. Third, space reengineering should have elasticity. As a dynamic and evolving organism, library spatial functions are not static. For example, the most distinctive project research spaces can be decorated, resources configured, and services customized according to different research topics and changing user needs to maximize satisfaction of project research requirements. This spatial plasticity

aligns well with the concept of "the Dao produces one, one produces two, two produces three, and three produces all things," proving very popular in practice. Fourth, equipment selection should have good compatibility and upgrade space to facilitate future functional expansion and extend equipment service life. Fifth, with the deepening of people-oriented concepts, libraries will continuously strengthen staff quality cultivation, forming a virtuous cycle of talent mechanisms to achieve sustainable development in human resource development.

### 3.3 Advancing Smart Library Construction with Intelligent Management Concepts

Taiyuan Normal University Library's new construction has established an intelligent management concept, demonstrating strong sensitivity and foresight toward information intelligent technology in spatial function design, reflecting both current practicality and high intelligence. First, in the comprehensive cabling system, considerations include applicability, reliability, advancement, and foresight, reserving lines for upcoming or potential intelligent equipment. Second, it has introduced an automated library business system integrating book acquisition, cataloging, retrieval, circulation, periodicals, and newspapers, achieving automation and connecting with digital library and RFID systems using a W/S structure that supports browser-based staff workstations. Third, the public service management system is equipped with self-service copiers and printers, providing comprehensive self-service for readers. Fourth, the library has established an RFID tag system for books to facilitate collection management and quick resource location while enabling self-service borrowing and returning. Additionally, it has implemented an intelligent access control system and campus card self-management, vigorously introducing intelligent equipment and strengthening intelligent management concepts to advance smart library construction.

## 4 Reflections on Spatial Service Innovation in University Libraries

### 4.1 Challenges Facing New Library Construction and Services

A library is a living organism, and new library construction is a continuous development process. Although Taiyuan Normal University Library's new construction demonstrates ingenuity in spatial function design, embodies humanistic concepts everywhere, considers sustainable development, and moves toward intelligent direction, its construction and sustainable development inevitably face challenges. To better understand these issues, the author conducted a questionnaire survey from November 3 to December 11, 2018, titled "Questionnaire on New Library Construction and Management in University Libraries," targeting all faculty and staff at Taiyuan Normal University. A total of 500 questionnaires were distributed, with 494 valid responses collected, including 341 undergrad-

uates (69%), 98 graduate students (19.8%), and 55 faculty members (11.1%). The survey results are summarized in .

The survey reveals several existing problems: First, book collection updates are slow and insufficient in quantity, failing to meet usage demands. Second, library supply cannot satisfy the growing cultural needs of readers driven by the "Internet Plus" and new technology revolutions. For example, nearly 50% of readers prefer self-service queries and locating resources through signage—simple and convenient services more suitable for the internet-native younger generation—yet current self-service equipment is incomplete, and systems such as self-service seat and study room reservations remain inadequate. Third, diversified space construction is insufficient, with new technology experiences failing to keep pace with the times and far from meeting readers' innovation and entrepreneurship needs. For instance, 37.85% of surveyed readers hope for new technology experience zones, 53.2% for discussion rooms, 38.87% for leisure and entertainment spaces, and 35.6% for art appreciation areas. Readers show strong desire to experience new technologies such as 3D printing, VR technology, and intelligent humanoid robots. In summary, the root causes of challenges facing Taiyuan Normal University Library's new construction and sustainable development can be summarized in three aspects: slow concept updating, insufficient funding, and inadequate human resources.

### 4.2 Strategies for Spatial Service Innovation in University Libraries

To address problems of outdated concepts, insufficient funding, and talent shortages, university libraries must transform from passive "sitting, waiting, and relying" attitudes to a new philosophy of "seeking support through service and development through contribution," closely centering on the core missions of teaching, research, and talent cultivation. By fully leveraging advantages in spatial function design, libraries should transcend, extend, and innovate "spatial services" to meet the transformational needs of university libraries in the new era, truly achieving supportive roles for university development.

**4.2.1 Innovating Service Models and Elevating Service Levels** The Association of Research Libraries (ARL) proposes that "by 2033, research libraries will transform from their role as knowledge service providers in universities to partners in the learning and research ecosystem." Libraries such as the University of Montana and the University of Cincinnati have also proposed integrating library services with their institutions' teaching and research ecosystems in their visions and goals, demonstrating that foreign university libraries attach great importance to their participation, role, and value in teaching and research activities. China's "Regulations on University Libraries" Article 30 states: "Libraries should actively expand information service fields, provide digital information services, embed themselves in teaching and research processes, conduct subject services, and actively explore new services according to needs." Teaching and research are top priorities in higher education, and university libraries should

utilize their resource, talent, and environmental advantages to embed themselves in teaching and research processes, participate in university teaching and research work, play indispensable roles, improve teaching and research efficiency and effectiveness, actively promote university development, demonstrate their own value, and thereby attract social investment in higher education and library development. For example, when Shanxi Provincial Government issued the "Opinions on Implementing the '1331 Project' to Coordinately Promote Double First-Class Construction," Taiyuan Normal University promptly responded by formulating and approving the "Implementation Plan of Taiyuan Normal University for Implementing the '1331 Project' to Coordinately Promote Double First-Class Construction." Under these new circumstances, Taiyuan Normal University Library draws on Shanghai Jiao Tong University Library's $IC^2$ innovative service model to provide high-level services of "entering academic departments, integrating into disciplinary teams, and embedding into research processes." By transforming concepts and actively participating in the three key focuses—key disciplines, key laboratories, and key team building—the library embeds itself in teaching and research processes, introduces relevant projects into library research rooms, fully communicates with teaching and research personnel to identify their actual and potential needs, forms strong alliances with its own information technology and knowledge service capabilities, and provides full-process, comprehensive embedded services for key projects. This approach not only improves overall teaching and research levels and attracts increased investment from the university and society into library construction and development, but also enhances librarians' knowledge service capabilities through innovative practice, thereby elevating the entire library's service level.

**4.2.2 Building Diversified Functional Spaces According to Different User Needs, Particularly Creating Innovation Spaces to Stimulate Creativity** Facing insufficient diversified space construction, outdated technology experiences, and unmet reader needs, university libraries should construct diversified functional spaces according to different user needs, particularly creating innovation spaces to stimulate creativity. Innovation is the inexhaustible driving force for university library construction and development. Taiyuan Normal University Library should first innovate service models to actively serve readers. Second, it should invite teachers and researchers to give lectures and guidance at the library, attracting students to participate. Third, it should build diversified functional spaces that readers truly need, particularly establishing digital reading experience zones, creating innovation spaces, stimulating creativity, and innovating spatial services.

**4.2.3 Developing Talent Cultivation Plans to Greatly Enhance Librarian Service Capabilities** As a newly established university with insufficient operating funds, Taiyuan Normal University unquestionably faces talent shortages, and the library's construction and development encounter similar difficulties. Therefore, the library must develop its own talent cultivation plan rather

than relying on external support. First, it should create a whole-staff learning atmosphere to meet the challenges of modern libraries to librarians' knowledge structure and service capabilities. Second, it should implement "bringing in" and "going out" strategies by inviting library experts and scholars for continuous training, actively hosting academic annual meetings to provide librarians with broader learning and exchange opportunities, and closely following academic frontiers and trends. Finally, by elevating service levels and embedding in university teaching and research processes, librarians can continuously enrich their minds, expand service spaces, and enhance service capabilities through the cyclical process of practice, knowledge, and further practice. Talent cultivation enables librarians to achieve continuous knowledge enrichment, spiritual growth, and job satisfaction, while also attracting outstanding talents to join library construction and development, thereby achieving sustainable library development.

New library construction is not merely about architecture and space, but an opportunity for library repositioning and service innovation. University libraries must clarify their positioning and development direction, taking physical space as the foundation, information resources as the basis, new technologies as the means, and service innovation as the guarantee to truly provide quality services for university teaching and research, thereby promoting higher education development, accelerating their own sustainable development, and achieving modern library transformation and innovation.

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