

University Library Makerspace Construction and Development Trend Prospects: Postprint

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Abstract

[Purpose/Significance] This study analyzes the rationale for constructing maker spaces in university libraries and summarizes their current development status, aiming to explore the current development objectives of university library maker spaces and propose recommendations for future development. [Method/Process] By examining cases of spatial transformation in domestic and international university libraries, this paper summarizes the existing problems and practical pathways in university library space renovation, with a focused outlook on future forms of spatial transformation in university libraries. [Results/Conclusion] Innovation and transformation have become the main theme for university libraries. The construction of maker spaces in libraries serves as a powerful catalyst for boosting talent cultivation and social innovation development. Facing the future development of university libraries, those with adequate conditions must transform, while those with insufficient conditions must also reform—this is the driving force of era development and the inevitable path for university libraries to move toward the future.

Full Text

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Prospects for the Construction and Development Trends of Maker Spaces in University Libraries

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Abstract

[Purpose/Significance] This paper analyzes the reasons for university libraries to construct maker spaces and summarizes their current construction status, aiming to explore the current objectives of university

library maker spaces and propose recommendations for future development. [Method/Process] Through cases of library space transformation both domestically and internationally, this study summarizes the existing problems and practical pathways in university library space transformation, with a focus on envisioning the future forms of spatial change in university libraries. [Result/Conclusion] Innovative transformation has become the main theme for university libraries. The construction of maker spaces in libraries serves as an effective remedy for boosting talent cultivation and social innovation development. Facing the future development of university libraries, those with adequate conditions must transform, while those with insufficient conditions must also change—this is driven by the development of the times and represents the inevitable path for university libraries to move toward the future.

Keywords: university library; space transformation; maker space; future form

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The construction of maker spaces in university libraries is currently a focal point of theoretical research and practical attention in the field. Maker spaces represent not merely a contemporary label for technology-oriented innovative business formats, but also possess social network value and cultural leadership functions. The innovative activities within maker spaces serve as an effective remedy for boosting talent cultivation and social innovation development. At present, social innovation has become a common interest and goal for numerous industries, particularly the education sector, in seeking development. The intermediary role played by university library maker spaces in the innovative development of education is immeasurable. However, in their actual transformation and construction processes, there is much more armchair theorizing than practical implementation, largely constrained by subjective and objective factors such as concepts, conditions, or experience. To promote the development of university library space transformation, this paper explores questions such as why university libraries should establish maker spaces, which libraries at home and abroad have already put this into practice, and the dilemmas and solution strategies in university library space transformation, while also providing prospects for their future development forms.

1 Why University Libraries Build Maker Spaces

The surging tide of the international maker movement is sweeping across China. With the maturation and ubiquity of internet technology, a maker movement guided by cultural concepts such as design, sharing, communication, collaboration, creation, and open source is rapidly spreading worldwide.

1.1 The Advancement of the International Maker Movement Tide

In his 2009 campaign speech, Obama stated, “I want us all to think about innovative ways to engage young people in science and engineering. Whether it’s

science festivals, robotics competitions, fairs, encouraging young people to create, build, and invent—to be makers of things, not just consumers of things.”[1] In 2012, the U.S. government launched a key project, planning to build “maker spaces” in 1,000 primary and secondary schools within four years to promote educational reform and innovation capacity building from the foundation of education[2]. At the higher education stage, students will learn through various practices or creations, gradually transforming from consumers to creators, and hands-on experiential learning has become the latest model for American higher education and talent cultivation. Therefore, the construction of maker spaces in university libraries is imperative, prompting libraries to form a wave of space transformation. Various university libraries have successively transformed and constructed academic maker spaces and fabrication laboratories, equipped with open-source hardware, 3D printing equipment, laser cutters, etc., to provide guarantees for cultivating students’ maker spirit and innovation capabilities. Meanwhile, in countries such as the United Kingdom, Germany, and Japan, the maker movement is also being carried out vigorously, particularly in innovation-renowned Japan, where maker concepts are deeply rooted in people’s hearts, with greater emphasis on integrating the “craftsman spirit” and innovation.

1.2 Implementation of National Innovation and Entrepreneurship Policies

The rapid importation of the maker movement to China has played a catalytic role in the nation’s basic strategy of innovation and entrepreneurship. In 2011, China began launching maker space construction, using maker spaces as bases to promote public innovation and entrepreneurship capacity enhancement and to support innovation and entrepreneurship companies. In September 2014, Premier Li Keqiang first proposed the call for “mass entrepreneurship and innovation”; in January 2015, Premier Li Keqiang personally visited the Shenzhen Chaihuo Maker Space, allowing more people to understand makers and expanding their influence and contribution to economic and social development; in February 2015, the State Council executive meeting explicitly formulated a series of policies supporting maker space development, providing a favorable policy environment and development platform for innovation and entrepreneurship at the national level; in March 2015, “mass entrepreneurship and innovation” was written into the government work report. Under the guidance of national macro-policies, various types of maker spaces have sprung up like mushrooms after rain, presenting a flourishing development trend, such as Beijing Maker Space and Shenzhen Chaihuo Maker Space, which have played positive roles in leading innovation and supporting entrepreneurship. In 2016, the Ministry of Education issued the “13th Five-Year Plan for Educational Informatization,” which also put forward clear requirements and plans for innovation and entrepreneurship education in universities.

1.3 The Need to Assist in Cultivating Innovative Talents

With the continuous rise of the maker movement, developing maker spaces and deepening maker education has become an era's choice for higher education reform and innovation, as well as for assisting in the cultivation of innovative talents[3], striving to unify the cultivation model with social expectations: (1) Maker spaces promote continuous innovation in higher education models through the combination and complementarity of innovation theory and entrepreneurship practice; (2) The spirit of innovative collaboration and shared creation cultivated in maker spaces promotes university students' learning of innovative technologies and shapes their innovative logical thinking; (3) As venues for carrying out and sublimating technological innovation activities, maker spaces facilitate the emergence of interdisciplinary and cross-field new products, technologies, and applications. The creation of maker spaces in university libraries can not only fully release the potential of libraries as hosts but also effectively play their supporting role in the innovative talent cultivation system. Future university libraries will place greater emphasis on community effectiveness, stressing the stimulation of readers' innovation capabilities and community vitality, and striving to create a third space for creative workers' innovation[4]. The functional positioning of future university libraries and the spirit of maker spaces have high consistency in their value systems, using maker spaces as bases to cultivate students' practical abilities in innovation and entrepreneurship, thereby demonstrating the value, responsibility, and mission of university libraries.

1.4 Information Resource Advantages of University Libraries

University library maker spaces are more convenient, higher quality, and more advantageous than other maker spaces. This is reflected in: (1) University libraries possess abundant resources and high-quality services. As auxiliary institutions of higher education, university libraries are rich in both virtual and physical resources, have relatively sufficient professional information talent, maintain clean and fashionable spatial environments, and serve high-caliber readers. (2) University library maker spaces can achieve multidisciplinary cross-fertilization, integration, and complementarity. Leveraging the strong scientific research capabilities and technologies of universities, maker spaces can realize interdisciplinary cross-fertilization, integration, and complementary cooperation, facilitating exchange and collaboration among makers from different fields. (3) The comprehensive abilities of student makers can be enhanced in libraries. Student makers require not only learning abilities but also creative and innovative capabilities, and library maker spaces provide them with venues and platforms for gathering, exchanging, discussing, creating, and displaying. (4) University libraries possess powerful social relationship networks. University libraries not only have experts in information and intelligence but also maintain extensive cooperative relationships with disciplinary experts, academic teams, school functional departments, as well as enterprises, social groups, and commu-

nities. These relationship networks also become important foundational capital for makers entering social entrepreneurship.

1.5 The Drive for Transformation and Innovation in University Libraries

University libraries are growing organisms that must transform and innovate under the drive of the times, implementing disruptive changes in management models and operational mechanisms. Only in this way can they keep pace with the times and maintain their irreplaceable supporting role and existence value in scientific research innovation. Space, resources, and service are the three main elements of modern university libraries, and any transformation and innovation must be derived from these three elements as foundations[5]. Maker spaces are precisely such a demand-side-driven product and one of the outcomes of the supply-side structural reform of university libraries. They represent innovations that transcend traditional library functions, being not only a series of physical spaces full of technological creativity but more importantly, integrated and intelligent solutions that incorporate resources, culture, and services using space as the carrier. Maker spaces can provide users with interdisciplinary and cross-field knowledge services through various types and dimensions of information analysis, comprehensively supporting research embedding and the cultivation of maker literacy, thereby reconstructing the core competitiveness of libraries. As one of the important solutions for the transformation and innovation of university libraries, maker spaces are rapidly becoming a focus of attention in the library community and represent a crucial breakthrough for libraries in implementing innovation and entrepreneurship development strategies.

1.6 Research Status and Purpose of This Paper

Since the emergence of maker spaces, research on the construction of university library maker spaces at home and abroad has been burgeoning. Currently, theoretical research on university library maker space construction is developing, focusing mainly on the introduction of the origin and connotation of maker spaces, the introduction of foreign university library maker space construction, the motivations for university libraries to build maker spaces, factors affecting the construction of domestic university library maker spaces, and recommendations for university library maker space construction. It can be said that these studies still belong to the category of basic research, with both the quantity and quality of papers failing to reach an in-depth level, thus having limited driving effect on the construction of university library maker spaces. In view of this, based on comprehensive investigation and summary of the current status of university library maker space construction both domestically and internationally, the authors conduct analysis and prospects of future forms of university libraries, aiming to prompt university libraries to re-examine themselves, seek new development opportunities and living spaces, and thereby enrich the theoretical framework of university library maker spaces.

2 Current Status of University Library Maker Space Construction

2.1 Construction Status of Foreign University Library Maker Spaces

Maker spaces originated in the United States. After years of exploration and development, the construction of maker spaces in American university libraries has accumulated practical experience, forming relatively mature and highly operational construction steps for preparation, startup, and implementation phases. Their construction funding comes from diverse sources, primarily government funding. In 2012, the U.S. government directly allocated funds to 1,000 universities to support maker space construction; in June 2016, Obama announced that 11 government departments would invest \$2.5 billion annually to support maker research and practice[6]. Additionally, there is support from departmental associations, such as funding from the MacArthur Foundation; the American Museum and Library Association provides financial support for innovation and creation activity projects. Crowdsourcing and mass innovation models are also sources of construction funding. The world-renowned crowdfunding platform Kickstarter successfully raised funds for 12,000 maker projects in 2011 alone, reaching \$100 million[7]. There are also various channels such as maker alliances, community partnerships, library-enterprise cooperation, social donations, and alumni donations. The construction forms of university library maker spaces vary according to the actual conditions of each school and library, with no limit on space size, varying amounts of equipment, and distinct spatial service characteristics (see Table 1). As of June 2015, among 1,929 well-known maker spaces worldwide, the United States accounted for 38.4%, with university libraries comprising the vast majority. Maker spaces in American university libraries are activity spaces where invention, creation, communication, and hands-on work can be implemented, effectively promoting the cultivation of university students' creative and practical abilities. Consequently, the United States has incorporated maker spaces into the service system of university libraries[8].

[illegible]

			Carnegie Mellon University Library
(USA)	Learning Intermediary Space	3D printing, manufacturing, experimentation, media black box, design, etc.	Simpson Library, University of Mary Washington (USA)
	On- and Off-campus Cooperation	3D printing, replication, photo printing, robotics, open access, etc.	Michigan State University Library (USA)
	Make@State	3D printing, rapid prototyping, motion capture, content scanning, etc.	Stanford University Library (USA)
	FabLab Laboratory	Laser cutting, 3D printing, design, engineering, etc.	North Carolina State University Library (USA)
	-	3D printing and scanning, cutting, milling, clothing making, etc.	Knapp Margaret Knapp Library, Wellesley College (USA)
	Media and Technology Center	3D printing, 3D scanning, laser cutting, somatosensory controllers, etc.	University of Texas at Arlington Library (USA)
	-	3D printing, 3D scanning, cutting, textiles, etc.	Shapiro Library, South-

ern New Hampshire University (USA) | Innovation Lab | 3D printing, design, digital scanning, etc. | | Columbia University Library (USA) | - | 3D printing, 3D scanning, creativity, design, rapid prototyping, etc. | | Odum Library, Valdosta State University (USA) | - | 3D printing, robotics, circuit design, video editing, display | | San Mateo College Library (USA) | - | 3D printing, melamine printing, binding, mold making, etc. | | Penfield Library, SUNY Oswego (USA) | - | 3D printing, creative practice, handicrafts, design, etc. | | University of Nevada, Reno Library (USA) | - | 3D printing, engineering design, dynamic experiments, lock-picking space, etc. | | Kent State University at Tuscarawas Library (USA) | - | Technology space production, Tollooty incubator, creative box collection | | Rogers Library, University of Alabama (USA) | 3D Studio | 3D printing, design software, FAQ service platform, manufacturing books | | Gardner-Harvey Library, Miami University (USA) | The TEC Lab | 3D printing, 3D editing, electronic knives, glass container manufacturing, etc. | | Middle Tennessee State University Library (USA) | - | 3D printing, wireless iPhone 5s, hummingbird robots, etc. | | University of Tennessee at Chattanooga Library (USA) | - | Various technical services including 3D printing | | Lovejoy Library, Southern Illinois University Edwardsville (USA) | Maker Lab | 3D printing, 3D scanning, multi-roll filament | | Dresden University of Technology Library (Germany) | SLUBresden | 3D printing, modeling, prototyping, etc. |

2.2 Construction Status of Domestic University Library Maker Spaces

The reconstruction of maker spaces has become one of the symbols of transformation and innovative development in domestic university libraries. Many universities are devoting the entire institution's resources to building innovation and entrepreneurship education centers or dual-creation practice platforms. Driven by this, the maker space transformation of university libraries has also achieved certain progress. The construction of maker spaces in Chinese university libraries lacks government investment and can only seek funding through school capital investment, school-enterprise cooperation, intra-campus joint construction, social donations, internal integration, and other methods to pool resources and collaborate on construction. Among these, school-enterprise cooperation represents the best model, such as the "Jiaoda-Jingdong Maker Space" established through cooperation between Shanghai Jiao Tong University Library and Jingdong Group[9], and the "Changrong Jianhao Cultural Maker Space" jointly established by Tianjin University Beiyang Garden Campus Library and Tianjin Changrong Jianhao Printing Technology Company[10]. These represent win-win models achieving integration of industry, academia, and research with practical application. Additionally, intra-campus joint construction is also a good approach, such as joint construction with various departments within the university that provide vacant premises, funding, and equipment to integrate resources and collaborate. Currently, the number of university libraries preparing for transformation and constructing maker spaces is increasing (see Table 2). These university libraries are typical examples that continuously solve problems, overcome difficulties, and put goals into practice during the maker space con-

struction process. Their practices have internally achieved resource guarantees for new services and provided successful models that other university libraries can learn from.

Table 2 Partial Cases of Domestic University Library Maker Space Construction

Library Name	Space Name	Main Functions/Services
Tianjin University Library	Changrong Jianhao Cultural Maker Space	Self-service quick printing, cloud printing experience, entrepreneurship training, competitions, etc.
Chinese Academy of Sciences Library	Haier-Zhongke Entrepreneurship Base	Provides resources, equipment, space for settled clients
Wuhan University Library	Information Commons	3D printing, Lezao makers, e-training, entrepreneurship roadshows, etc.
Shanghai Jiao Tong University Library	Jiaoda-Jingdong Maker Space	3D printing, drones, smart bracelets, robots, and other collaborative creation platforms
Chongqing University Library	Information Commons	3D printing, robotics, smart cars, data valley practices, etc.
Southwest Jiaotong University Library	Jiaoda Maker Space	3D printing, laser cutting and engraving, electronic production, open-source hardware training, etc.
Peking University Library	Information Commons	Java, microcontrollers, 3D printing, etc.
Tsinghua University Library	Information Commons	Skills training, brainstorming, guest sharing, maker marathons, etc.
Shenyang Normal University Library	Information Commons	Creative sharing, innovation and entrepreneurship guidance, maker lectures, entrepreneurship reality shows, etc.
Nanjing Normal University Library	Information Commons	3D printing, electric pianos, high-definition e-books, etc.
Zhejiang University Library	Information Commons	Multimedia production, audio-visual, subject services, information literacy education
Sichuan University Library	Information Commons	Discussions, MAC and DELL innovation experiences, creative displays
Xi'an Jiaotong University Library	iLibrarySpace	New technology experiences, digital reading, academic exchange, learning sharing, etc.
Nankai University Library	Information Commons	Discussions, exchange and interaction, product exhibitions, etc.
China Three Gorges University Library	Red Dot Maker Space	Technology experience, innovative learning, group discussions, audio-visual appreciation, etc.
Ocean University of China Library	Information Commons	Creative design and manufacturing, creative product display, group discussion areas, etc.
Hebei University of Engineering Library	Information Commons	3D printing, open-source hardware, design innovation, work display, etc.
Xi'an University of Posts and Telecommunications Library	Information Commons	Patent information analysis, data mining, user experience, etc.
Nanjing Tech University Library	Information Commons	3D printing, Industry 4.0 popular science exhibitions, various designs, work exhibitions
Harbin Institute of Technology Library	Information Commons	Cultivating innovation culture, knowledge transformation, capability development, entrepreneurship platform, etc.

2.3 Dilemmas and Solutions for Domestic University Library Space Construction

2 [Figure 2: see original paper].3.1 Dilemmas in Maker Space Construction The construction of maker spaces in university libraries lags behind that of social maker spaces, showing insufficient motivation and weak willingness in building maker spaces. Apart from issues of conceptual understanding, funding for construction or transformation has become a bottleneck for transformation and innovation. The dilemmas in maker space construction also include: (1) There are no specific policy requirements regarding whether university libraries should build maker spaces, leaving the decision entirely to leaders' conceptual understanding and enthusiasm; (2) The transformation of library maker spaces lacks special government funding support, requiring libraries to raise all funds and equipment themselves; (3) The construction of maker spaces at the school level, departmental level, and library level lacks overall planning, leaving libraries at a loss; (4) Libraries have insufficient professional service teams for building maker spaces and lack technical strength; (5) The school level has already built maker service centers, leaving no additional energy or financial resources to build separate ones in libraries. These various issues have caused most university libraries to remain indifferent and in a state of hesitation and predicament.

2.3.2 Solutions for Maker Space Construction No matter how great the difficulties, they should not hinder the pace of transformation and innovative development of university libraries. Assisting “dual-creation” education is an unshirkable responsibility, and serving and cultivating student makers brooks no delay. Responsibilities must be undertaken and missions fulfilled, actively seeking ways out for transformation and development. University libraries should: (1) Actively coordinate and rationalize relationships with school authorities, handle construction models properly, and avoid redundant construction and resource waste; (2) Strengthen cooperation and interaction both inside and outside the university, raise funds through multiple channels, and strive for cooperative joint construction for mutual benefit; (3) Transform existing library structures, integrate traditional layouts, aggregate classic resources, and build multifunctional spaces; (4) Form elite service teams, increase human resources training efforts, improve cognitive levels, and enhance technical capabilities; (5) Perfect service management mechanisms, strengthen the combination of review, supervision, and assessment, and maximize promotion and planning to improve efficiency. As social development enters a new normal, the transformation and innovation path for university libraries becomes even more challenging, requiring comprehensive consideration and dynamic balance in terms of strategic nature, operability, and forward-looking vision.

3 Recommendations for Current and Future Development of Library Maker Spaces

3.1 Transform and Expand Library Space

Modern university libraries are not merely places for simple book borrowing and reading; they should extend their various functions according to the new changes of the times. They must strive to integrate and expand their spaces by creating learning and innovation environments and extending multiple service functions, transforming libraries into learning commons, maker spaces, discussion platforms, leisure venues, cultural activity centers, etc. In spatial transformation, the establishment of learning commons is extremely important, with maker spaces being indispensable. These are essential spaces for university students' learning and creative research, where they can “be seen learning and creating” or “see others learning and creating,” recognizing that learning and creation are highly valuable and can stimulate their learning and creative behaviors, generating a sense of urgency about learning and creation[11]. The construction of maker spaces in Chinese and foreign university libraries has established exemplary models for us. Their spatial transformations are all disruptive and destructive changes to traditional libraries, with transformation strategies focusing on how to recreate effective spaces to inspire students to learn and innovate. The future development of university libraries should be that those with adequate conditions must transform, while those with insufficient conditions must also change—this is driven by the development of the times and represents the inevitable path for libraries to move toward the future.

3.2 Resource-Coexisting Collection Space

The document carriers in university libraries constantly change and enrich along with technological development and progress, with different eras having different document carrier forms. For instance, from print-based paper documents with the longest duration, to microfilm and magnetic disks and optical discs in previous years, to today's optical and electronic carriers, as well as multimedia information transmitted through network information highways. Particularly multimedia information presents readers with three-dimensional graphics and vivid, colorful, dynamic information, whose realism far exceeds that of paper documents. From this, we can foresee that new forms of library collection resource carriers will continue to emerge in the future. All document resources in university libraries can be digitized into “data” in certain formats, and the proportion of virtual elements such as electronic collection resources in libraries is increasingly high. However, we must believe that virtual electronic documents will never completely exclude physical paper documents. Future university libraries will feature a resource-coexisting form where print documents and electronic documents coexist, where physical document resource collection spaces and virtual document storage spaces exist simultaneously—two main resource carriers coexisting, mutually promoting each other, and neither can be neglected.

3.3 Innovation-Incubating Space

Maker spaces represent a new trend for humanity in seeking development and innovation and constitute an important direction for the future spatial development of university libraries. University library maker spaces provide the use of digital desktop tools, share cultural norms of design and online collaboration, and facilitate the application of universal technical standards that promote sharing and rapid iteration. In these spaces, readers can realize ideals and aspirations such as learning knowledge, increasing wisdom, generating creativity, acquiring skills, exploring creation, and incubating innovation. For example, the maker space at Wuhan University Library provides free audio-visual equipment, meeting venues, entrepreneurship roadshows, exhibition platforms, and other services for university students' innovation and entrepreneurship cultural exchange activities, cultivating and laying the conceptual and capability foundations for students' future social entrepreneurship. Maker spaces are also media laboratories for the next generation of university library readers, used to explore creative arts, technology, science, and enterprise. University libraries should utilize their inherent resource advantages to support innovation and promote creation. Libraries should provide display spaces and rendering platforms for the celebration and exhibition of various works, products, projects, or inventions. Future university libraries will be spatial venues where concepts and ideas can be transformed into products or maker experiences[12], and their role in cultivating maker literacy and incubating innovation is remarkably inspiring.

3.4 Education-Experience Space

Future university libraries will feature digital media experiment spaces with various functions—namely, spaces that satisfy dual-creation education experiences, such as the video editing space, MOOC production space, and new function experience space at Shenyang Normal University Library. There, activities can be implemented such as digital application terminal experience services for the latest digital devices, 3D printing experiences, iOS system usage training, Xiaomi product experiences, and innovative business workshops. Readers can utilize video recording, editing equipment, computers, and recording studios with keyboards and turntables to learn graphic design, blogging, photography, and other content they are interested in that also helps with career planning. The main functions of these experience spaces include: (1) Stimulating creativity: Continuously bringing new ideas and technologies to readers through digital media space activities. (2) Embodying differentiation: Digital media spaces can reflect the differentiation of creation in the personalized era. (3) Highlighting experiential quality: In digital media spaces, readers can form important experiential feelings about digital media based on visual, emotional, thinking, and action elements. (4) Emphasizing communication: On digital media space platforms, exchange, interaction, and communication among readers can be formed. (5) Achieving relevance: Digital media spaces can provide interactive products in areas where readers have strong interests, achieving relevance services such as

audience segmentation, precision, and interaction[13].

3.5 Collaboration-Emphasizing Social Space

University libraries should focus on providing informal learning spaces that satisfy readers' needs for open dialogue in learning and research, expose them to multi-dimensional learning and practice, and encourage collaborative learning. This is highly operable for today's university libraries: (1) The use of network electronic technology tools in university libraries saves considerable space. For instance, domestic university libraries such as Peking University and Tsinghua University have already solved these issues, using the saved space to create broader service projects. (2) In future university libraries, traditional learning spaces and social spaces will be inseparable and may even intersect, which runs counter to traditional practices of area isolation and noise control. For example, the spatial zoning design of the Hong Kong University of Science and Technology Library has intersecting functions, with group discussion spaces near quiet areas, becoming places where readers can find friends and conduct learning research. (3) University libraries can also open social media platforms for extensive social promotion, promoting and answering research questions, providing book recommendation forums, and realizing the combination of online and offline social activities. This serves as the most convenient and best feedback platform for university libraries to obtain socially needed projects, improve services, and select books, and has an irreplaceable advantage in supporting online discussions[14].

3.6 Culture-Art Encouraging Space

Future university libraries should establish spaces that encourage and support the development of culture and arts according to the school's educational objectives, such as museums, mini-galleries, music studios, art centers, and other forms. The cultural display space, audio-visual playback space, and music appreciation space reconstructed at Shenyang Normal University Library have been successfully implemented as cultural and art spaces. The audio-visual playback space offers art courses such as tea ceremony and cocktail mixing, plays films for free, and provides free multimedia teaching and film salons for teachers and students. The music appreciation space provides teachers and students with a rich variety of music resources, where readers can appreciate music, learn music theory, practice playing, do ear training, and experience the charm of elegant art. The cultural display space irregularly holds various public welfare exhibitions, displaying works and organizing small-scale performances in calligraphy, fine arts, fashion design, photography, paper-cutting, couplets, small productions, etc. Through cooperation with collectors and artists, it provides a cross-cultural exchange space and a home for new art creation for university student readers. Future university library cultural spaces should provide visual and sensory stimulation for the learning environment, promoting creativity, imagination, and knowledge association.

The various new forms of library spaces described above are extending and developing and cannot cover all the changes that will occur in future university library spaces, but innovative transformation has become the main theme. What forms will future university library spaces take? Where will library services head? These questions continuously provoke thinking among industry experts and prompt them to begin planning the development blueprint for future libraries. Professor Zhu Qiang, Director of Peking University Library, proposed that library maker spaces should be “knowledge laboratories” and “wisdom processing workshops,” allowing knowledge to be better enriched, shared, and experimented with, and helping to enhance student capabilities[15]. Professor Cheng Huanwen, Director of Sun Yat-sen University Library, once said: “The third-generation library gives people broad imaginative space. Perhaps a pure third-generation library will be a form of complete digital information resources + internet + new service models.”[16] Mr. Wu Jianzhong, former Director of Shanghai Library, believes: “By 2025, libraries will become knowledge centers, learning centers, and exchange centers. Their main function will not only be to provide books and information but to fully leverage their professional skills and resource advantages to develop toward supporting human learning and creating knowledge environments.”[17] We believe that facing the current digital era of maker movement development, “maker spaces” are the “spokespersons” for innovation, creativity, and maker practice activities, representing a new form of university library services in the new era, and their brand image deserves in-depth promotion.

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Author Contributions

Wang Yu: Developed research ideas and outline, wrote the paper, revised the paper;

Sun Peng: Organized materials, created tables, proofread the paper.

The Development of the University Library Maker Space and Its Trend

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Abstract: [Purpose/Significance] The transformation of library space is the focus of current theoretical research and practice. With the change of the information technology environment and readers' demand, the library is forced to re-examine itself and seek new development opportunities and living space. [Method/Process] Based on the statistical cases of the spatial transformation of

university libraries at home and abroad, this paper sums up the existing problems and practical ways of the transformation of the library space, and puts forward the prospect of the new form of the future spatial change of the library. [Result/Conclusion] The innovation of library has become the main melody. The maker space is a recipe development and social innovation culture to boost the talent library reengineering. As for the future development of the university library, it will transform or change considering its own conditions, which is driven by the development of the times, and is the only way which must be passed.

Keywords: university libraries; space transformation; maker space; future form

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

Source: ChinaXiv — Machine translation. Verify with original.