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Research on the Principles, Strategies and Methods of Building up Makerspace in University Libraries

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***Abstract*—Creating Makerspace has added "innovation" color to the existing service mode of university library. Its appearance is quietly changing and remodeling the existing service mode of university library, bringing new opportunities to the library in transformation. With the development of modern information technology, users' demand for library services is showing a trend of diversification, and the mode of library service has also changed. In the era of digitalization, traditional university libraries are facing many difficulties in development. The natural fit between University Library and Maker movement indicates the direction of transformation. On the basis of introducing the concept and characteristics of Makerspace, this paper expounds the significance of introducing service space in university library service, and probes into the principles, strategies and ways of creating the library Makerspace in university library.**

***Key words*—University Library, Makerspace, service model, continuous development, service model.**

I. INTRODUCTION

Service innovation is one of the eternal themes of the library. In the new era of rapid development and highly developed information technology, university libraries, as an important support for information services in universities, should make full use of information, create information and innovate service modes, so as to constantly meet users' diversified needs. The creation of Makerspace is a new thing in the background of the times, which provides an opportunity for the innovation and development of the university library [1]-[9].

With the development of modern information technology and the rapid growth of electronic resources, users' demand for library services is showing a trend of diversification. Traditional lending services, reference services and other services are marginalized. The library is in the complex environment of the new and old mode, and it is exploring the way of the transformation of the innovation and development. As an exotic, Makerspaces in the overseas development has been relatively mature, and penetrate into education, government and other fields. The rise of Makerspace provides a new opportunity and vitality for the service innovation of the library in the new period. At present, under the background of "mass entrepreneurship and innovation", it is the bounden duty of libraries to understand and analyze the construction of domestic and foreign libraries, and provide intellectual support for social innovation and transformation.

II. CONCEPT OF MAKERSPACE

"Maker" is derived from the English word "hacker", which refers to a type of person who can convert the idea into a reality or a real object. The activity content of the Maker often has a certain technical challenge and dense knowledge content, which is regarded as a new way of knowledge transfer. "Makerspace" originates from the "Maker campaign". Its English name "Makerspace", "Hackerspace" or "Hackspace" refers to the open space of aggregated the public, promoting the public to cooperate with each other, share knowledge and create new ideas and new things together. It is generally believed that there are three dimensions of the concept of Makerspace. One is the environment, characterized by shared resources. The second is the idea of sharing resources with cooperation. The third is function, which is based on promoting creation. With the great creativity of the Makerspace, the building of Makerspace has gradually risen to the development strategy of many countries. Makerspace provides a place for creative people to provide creativity and communication, interaction and innovation, and the integration of creative ideas and products. People often have a common interest in computers, engineering, digital art, or electronic art. They promote knowledge sharing, consumption, cross-border collaboration, creativity and product by providing open communities, virtual space, prototyping processing equipment, and organizing related parties and workshops.

III. FEATURES OF THE MAKERSPACE

The creation of a Makerspace has several notable features:

A. Willing to Share

In the open environment of different industries, we create experiences and technologies, share resources and knowledge to achieve their ideas.

B. Open Source Access

The open source is based on the open source code in the IT field, including code, data, design diagram and other hardware and software. Open source open platform enables

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customers to stand on each other's shoulders, greatly promoting the speed of innovation.

C. *Pay Attention to the Creation of Labor*

Creativity is expressed in a personalized way, personalization stems from extensive interest, exploration in different fields, independent judgement and dedication. It provides free space for more people to meet individual needs, so that everyone has the ability and opportunity to work creatively.

IV. The Significance of the Introduction of the Makerspace in the Service of the University Library

In recent years, the development of Makerspace is "in the ascendant". Based on this factor, "Makerspace" has been paid more attention in the field of library by virtue of its own characteristics. From the public library to the University Library and other academic and professional libraries, the building of the Makerspace is actively explored. At the same time, the function of Makerspace to enhance the potential learning ability and excavate the consciousness of innovation has also been recognized by the library users. It can be seen that the building of a Makerspace will change the traditional library service, improve the service quality and level of the library, and make the library a real learning center.

By introducing the Makerspace into the library, we can effectively fill in the blanks between classroom teaching and extracurricular practice, and provide users with more opportunities to learn independently and innovate. At the same time, the construction of Makerspace can reorganize the service mode of library, improve the service quality and level of library, and further improve the influence of Library in school and society.

The value of creating a Makerspace is to provide creative communication, thinking interaction and various equipment and facilities for Makers. By introducing the Makerspace, creating experimental practice platform, network community application platform and seminar room, the university library helps the library to establish stable reading and reading relationship, and provide knowledge and innovation opportunities for different disciplines and professional teachers and students. This is beneficial to the cultivation of innovative and applied talents in Colleges and universities.

The building of a Makerspace is of great significance to the development and construction of the library and the innovation of the way of service. It is mainly manifested in several aspects.

A. *The Innovation of Library Service Mode and the Transformation of University Library*

The university library has always provided information and access to teachers and students to meet the needs of teachers and students. However, the electronic resources in the digital information age are very easy to obtain, and the library is facing the increasingly marginalized predicament. The traditional library can not meet the needs of teachers and students, and it is urgent to change. The creation of a Maker culture is the opportunity for the transformation of the library. The historical role of the library is to provide a "tool of knowledge", which is exactly the same as the culture of Makerspace. The most important reason for creating a user space into the university library is that it can bring science, technology, engineering, art and mathematics into the library's syllabus and plan. The creation of a Makerspace has created an advanced technology and equipment, in the process of sharing and cooperation to acquire the space of knowledge, and provide an environment for knowledge innovation. It builds a platform for communication and cooperation between different disciplines. Here, the people of different disciplines and professional backgrounds communicate and cooperate, and use advanced technology and advanced equipment to achieve a comprehensive and interdisciplinary project.

The Makerspace is a part of the organism of the library. The library not only provides space, equipment, but also the role of librarians. Makerspace is equipped with professional and sophisticated equipment, and the use and maintenance of the equipment needs to be trained and tracked by the technical staff of the library. In the process of project discussion or later implementation, librarians can provide technical guidance or support on information and equipment. Dougherty thinks that librarians should take part in the event of guests, and feel the enthusiasm and vitality of customer culture, so that libraries can provide more support for customers.

Makerspace contributes to the innovation of library service, library of the deep value of mining, real become the "brain"; changes in response to the needs of teachers and students to help the library, enhance the sensitivity; can bring teachers and students through hands-on knowledge discovery more fun, experience sharing, cooperation to achieve the goal of joy, strengthen the attraction of library to readers.

In recent years, great changes have taken place in the social environment and technology environment faced by libraries. Their social values and missions have been greatly challenged. Libraries are undergoing positive transformation to adapt to today's complex new situations. The rise of Makerspace and Maker culture provides a good opportunity and breakthrough point for library transformation, so that libraries can provide better social mission for environment and resources to better conduct knowledge innovation, and provide support for human lifelong learning. From the perspective of service, introducing Makerspace into library helps expand service area and service area, so that readers can understand and contact more, more updated and more advanced technologies and methods.

B. *Promote the Core Competitiveness of the Library and Promote the Development of the University Library*

The building of a Makerspace in the library can adapt to the changing needs of the readers and cultivate their ability to create knowledge. Makerspaces can also promote the transformation of readers' learning style, teaching theory of

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the transformation of traditional culture to a certain extent. The establishment of a new practice of learning culture, not only impart knowledge to students, but also enable them to take the initiative to learn and use of technology, improve the practice ability. The creation of Makerspace is different from the conventional teaching and scientific research model. It is a model to promote students' self-driven and participatory research. It converge students' team strength with problem-guided and project-driven way to stimulate students' academic interest. At the same time, users can get rich and interactive collaborative innovation experience, making the library an effective space for lifelong learning and personal development, so as to enhance the library's charm index in the user's mind, enhance the core competitiveness of the library, and promote the continuous development of the library.

C. Provide the Opportunity of Hands-on Learning to Improve the Quality of Students in an All-round Way

By introducing the Makerspace into the library, it can provide and create rich, interdisciplinary and multi-types of learning and practice opportunities for students. In Makerspaces, students have equal opportunities to use a variety of resources, let the student carry on the scientific exploration according to their interests, actively experience the fun of learning, learning efficiency is improved; students can cooperate create PPT presentations, posters, videos of various models and prototypes, brainstorm, plan, design, testing and feedback the recycling process, not only contributes to knowledge mining and innovation, broaden the horizons of students, active thinking, creative consciousness, improve the ability of innovation, and promote the improvement of students' comprehensive quality.

D. Contact the Most Advanced Technology and Increase the Opportunities for Students to Start a Business

The creation of Makerspace in University Libraries allows students to reach the most advanced technologies, such as 3D printers, milling machines, laser cutting machines, and fast printing machines. Colleges and universities are the places that bring together the most dynamic and creative talents. The 3D printer and other technical equipment introduced by the library provide free creative tools, technology and space for students with ideas, enabling them to design and build projects. The library to help students acquire new knowledge and skills and the needs of the market, the invention and creation may be after the material conditions of entrepreneurship. The library Makerspace for students to create a team cooperation, sharing and independent creation environment, so that students can learn to use resources to solve new problems emerging in the creation process, and to improve their technological and psychological quality, which is conducive to the cultivation of entrepreneurship. By providing cutting-edge tools and technologies, Makerspace enables students to get in touch with advanced technology, help them build design projects, acquire new knowledge and develop skills, and eventually form new opportunities for employment and entrepreneurship.

E. Strengthening the Participation and Interaction of the Readers Will Help to Better Maintain the "Library Reading" Relationship

The introduction of Makerspace in university libraries can provide a new and rich interdisciplinary environment for readers to design and other activities. Communication and interaction among people who have common interests in Makerspace, to achieve interaction between communication and personality, emotion and experience, is conducive to the dissemination, sharing and innovation of knowledge.

F. Provide More Service Opportunities and Expand the Popularity of University Libraries

The core mission of university library is growing, learning and exploring the power of teachers and students, especially when the university library is trying to become the campus in the "wisdom hub", from different disciplines where students, faculty and staff to gather together, to explore, create and accumulate new knowledge. The University Library perfectly fills the gap in the school education system, and gradually expands the popularity of university libraries by providing support for materials, venues and cooperation space. Expanding the Makerspace to university libraries can provide more opportunities for voluntary and creative learning, and provide a space environment that can be used as an incubator for ideas and a tool for rapid, materialization of ideas.

G. Give Full Play to the Subjective Initiative of the Readers and Effectively Cultivate the Creativity of the Readers

Makerspace focuses on the development of personal initiative, like DIY, which encourages students to learn and create on their own initiative. In traditional education, hands-on learning and innovation are often ignored, which is often regarded as meaningless play. This "play" is devoted to the training of critical thinking and problem-solving skills. As Dr. Stuart Brown says, through "play", we will occasionally find new ways of behavior, ideas, strategies, sports, or the way of existence. Without any command, an important idea of natural eruption of curiosity is to embody the self. They will burst out huge energy to realize their creativity and ideas. Moreover, diversity and sharing in the Maker culture are inclusive and affinity, allowing more people to participate, greatly reducing the threshold of public innovation.

V. Principles of Building up Guest Space in University Library

A. The Principle of User Demand Oriented

The famous American management thinker Adrian Silaiwosiji wrote in "on demand": demand is the essential force to create great business legend. Only to know what the real needs of the users is, we can provide the products and services that meet the market. In the era of the Internet today, great changes have taken place in the reading needs of university library users: (I) reading carrier, with the rise of intelligent mobile phone, the user reading carrier gradually

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from the traditional paper books to read the mobile phone or computer; (II) the way of reading, along with the rapid development of Internet technology, electronic technology and scanning technology in the library, readers not only through a network cable to a display terminal, can any library from the world in electronic information resources and online database resource library through reading; even some help build 3D Library of 3D virtual technology, people can directly experience online library functions and services, the way of reading development change. (III) reading content, although the user group of university library is more clear, mostly for teachers and students, reading resources tend to provide relevant journals and books for research information. But with the arrival of the innovative society, users' knowledge needs are no longer confined to books that only provide static information resources, but also pursue "dynamic knowledge" that can bring practical experience and spiritual enjoyment. Bring the change of the society needs of users because of the change of library services in need of reform, library Makerspace provides a good starting point to meet the various needs of users, so that the library can better provide a favorable environment and resources for knowledge innovation, to provide support for human lifelong learning.

B. The Principle of Practicality

The principle of practicality is mainly embodied in two aspects. One is the local practicality of the content of the service space service. The university library is different from the public library and school library, based on the basic properties and characteristics from the local university library, carry out targeted services, related to the school curriculum, mainly for teaching and research services. The other is the social utility of Makerspaces services. A passenger space is the soul of "innovation".The tools used are new tools of social services, and the only consistent with social development, consistent with the needs of users have created contemporary significance.

C. The Principle of Cooperation

The library daily work cannot do without the support of other departments, such as cooperation with the publishing house, to obtain MARC data. Booksellers cooperation, access publishing information and realize the library cataloging outsourcing, and information institutions, cultural institutions cooperation, implementation of digital resources co-construction, resource sharing. Cooperate with other departments of the unit, to achieve cooperation, cooperative training user interview. The construction of library Makerspace is a comprehensive system engineering, and it needs the cooperation of other departments. To strengthen exchanges and cooperation between the Makerspaces and the other departments to make Makerspace, really into the library. Foreign libraries and other institutions, strengthen the cooperation, the school library and the school teaching department, teachers and students, the public library should be with the community of experts, companies, enterprises, institutions of education public organization, archives, museums and other cultural sector cooperation, make full use of various resources, to provide protection for Makerspace operation. This transboundary exchange and cooperation can achieve the long-term goal of sharing resources, mutual benefit and win-win situation.

D. The Principle of Open Source Sharing

Open source sharing is the main theme of the Internet age. Chris Anderson wrote in the Makerspace•New Industrial Revolution: the most important change in the Internet age is that we have new tools to share online. Online sharing brings inspiration to others and creates opportunities for cooperation. Creativity is magnified because of sharing, and the project is likely to be the seed and germination of products, sports and even the industry because of the sharing of development into a team project. "Everybody does it together" does have the possibility of becoming an innovation engine. Creativity is so simple and spread in sharing. University Library as an intellectual resource gathering, we should stick to the principle of sharing their source, ideas and thoughts through the virtual space to open, in creating community college or spread through the Internet based on the line to share the world with makers of common interest in making who can develop projects with the lowest cost, create innovative environment of university library open free.

E. The Principle of Mobility

The principle of mobility is embodied in three aspects. The first one is the mobility of physical equipment. Different projects will create different physical devices, choose mobile physical devices, and make adjustment according to users' needs. In a passenger space equipped with sufficient access and mobile power supply socket, convenient for users to use. The second is the principle of user mobility. The type of service to the library Makerspace after more abundant, the user at the completion of the project is inevitably to use a variety of services to the library, so in order to make reasonable planning space layout, to the library service distribution, users in the process of moving quickly to obtain resources and service needs. The third is the service personnel mobility and that the personnel should be integrated into the user, timely find and solve problems. In addition, you can also set the call button, to ensure that the service personnel on call.

F. The Principle of Security

Ensuring the security of the user is the basic starting point for the library to carry out its service. The creation of a Makerspace project in university libraries will inevitably introduce some mechanical tools and experimental equipment, which have certain security risks. A passenger space as a new service of the library, the library for most of its safety management is unfamiliar. Libraries should consider the possible security problems in the creation, formulate corresponding security issues management measures and positive measures based on the successful experience of other security mechanisms of the museum. At the same time, the reasonable layout of production space, buy environmentally friendly raw materials, for the existence of security risks of experiment or production projects, be sure to do a good job

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training, several aspects to protect the personal safety of users.

G. The Principle of Sustainable Development

Sustainable development is the eternal theme of human development. All along, the library to the "cultural heritage achievements, provide information, knowledge and cultural service" as its core mission. But with the development of the Internet, to meet the information needs of users the tools become more and more diversified, users receive the information channels and forms of increasingly diversified. Park library is faced with admission reduction, low circulation rate of books. At the same time, university library users usually do not come to the library because of their interest, mostly just to cope with temporary learning. In the face of such a situation, began to introduce various types can increase the charm of the university library library projects and activities in domestic universities, such as parent-child activities, staff education activities, establish the coffee bar and so on. However, behind the introduction of various activities in and create a project, need to recognize that reading is the traditional library from first to last and the main business. The development of traditional business can not be ignored, and to catch up with the trend of the times, it should be based on the priorities, and provide all kinds of services for the library construction project to bring new vitality and, in order to maintain the sustainable development of library.

VI. CONSTRUCTION STRATEGY OF MAKERSPACE IN UNIVERSITY LIBRARY

A. Comprehensively Assess the Influencing Factors and Actively Build an Equal, Open and Harmonious Space Environment

Based on a comprehensive and objective investigation and assessment of factors that may influence the construction and operation of Makerspaces, we should create an equal, open and harmonious space environment. The space environment mainly includes physical space and virtual space. On the one hand, a physical space, first of all, the physical space of university library is a limited area, the sustainable development of specific passenger space location to begin construction of its physical space or re planning of library space resources and re-planning from zero. This is the first to consider the problem of library. Secondly, the library has always been a quiet and solemn learning space, and the creation of space is an open space, and there are essential differences in the way of learning. How to make the production and communication space mainly "moving" into the library reasonably and completely, the noise tolerance of library is also a problem to be considered. Again, according to the Ministry of Education recently issued the "ordinary high school library regulations" stipulates that the library in the school opened a week teaching time should not be less than 90 hours. Holidays should also have the necessary opening time, conditional school according to the actual needs of the open network resources all day long. The service should be done all day long open 24 hours. Due to the limited resources, the main service object of some university libraries is the teachers and students in Colleges and universities, and it has not benefited the people of the community. The core concept of Makerspace is sharing. Users who bring different academic backgrounds and different life experiences share their explicit knowledge and tacit knowledge through this communication platform. The construction of University Library Makerspace is open to the community, how to open is a problem worthy of discussion. On the other hand, the development of the concept of a famous social networking site Facebook provides a good enlightenment to library Makerspace, namely the freedom to participate in an open communication system allows the user to type DIY and feedback. The Internet is a tool for the people of the world to communicate. The university library should make use of the Internet to inter library collaboration, share the advantages of creating the user space, make up for the lack of resources in the university library, and create an equal, open and harmonious ecological learning space for users.

B. Pay Attention to the Diversification of the Way of Building the Guest Space and Improve the Adaptability of the Creation Space to the Social Development and Change

As a combination of knowledge and practice, library Makerspace can take diversified ways of construction, such as school library independent construction or school enterprise cooperation. The independent construction of Makerspace, university library can independently develop and research related to various types of practical projects, students can focus on learning without being disturbed outside pressure. For example, the creation space of Wuhan University library, from indoor layout, cultural decoration, beverage snacks production to operation and maintenance, is designed and completed by college students independently. Of course, we should pay attention to the fact that independent libraries should have sufficient funds, space, resources and other advantages to prevent the lack of stamina. The school enterprise cooperation Makerspaces, the introduction of a foreign can alleviate the library financial pressure to some extent, and has value for all kinds of ideas and projects to bring investment and market potential. On the other hand, in reality, the University Library as an intellectual resource gathering, most are still in the experimental research or is the theoretical stage. At the same time, the main force in the enterprise sales and enhance corporate value, research and development is also inadequate and insufficient, the cooperation type Makerspace integration in research and development and enterprise technical force, in the Internet environment, gather all kinds of information resources to solve practical problems and all kinds of major problems in the innovation. To promote the development of innovation and industry upgrade.

C. The Development of Customer Space Service Needs to Close the Distance between Teachers and Students

University Library in providing Makerspace service, to the check that the needs of the content and forms of demand a full investigation. Its activities and services is close to the real life of teachers and students experience learning tasks, the task of

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the research of typical cases, the research task or activity curriculum. Not only can we bring the practical problems from social life into the creation project, but also we can absorb students to participate in the construction and management of the innovation space, the choice and purchase of learning tools. It can guide students to integrate learning and application in the process of hands-on operation, independent exploration and solving problems, so that students can master various kinds of life application technology in the process of activities and enhance students' interest in active learning. At the same time, after launching the customer service, we should actively record and investigate whether it meets the needs of users and whether it has practical applicability, so as to continuously improve the contents of library services and improve the quality of library services.

D. Integrating the Service of Makerspace into the Teaching and Research Activities

Makerspace project requires the participation of certain knowledge base, such as SMATEF (Science, technology, engineering, mathematics, art), teachers and students in the use of these basic knowledge support Makerspace learning at the same time, but also to consolidate and deepen their understanding and grasp, even to get new inspiration from and to acquire new knowledge. Meanwhile, in the university library, teachers and students from different disciplines can gather together to explore, create and share together. When encountering knowledge bottleneck, they can also use library's literature resources to seek answers and enjoy learning and production in calligraphy.

VII. BUILDING WAY OF MAKERSPACE IN UNIVERSITY LIBRARY

According to whether the University Library Cooperation and other university departments and enterprises to jointly build a Makerspace classification. It will be divided into three categories: University Library Construction of independent record passenger space, library and school related departments cooperation in the construction of Makerspaces and common Makerspace cooperation.

A. The Independent Construction and Operation University Library Makerspace

The University Library Construction of Independent College Library Makerspace is solely responsible for the infrastructure construction. Makerspaces provide maxspace growth environment such as platform environment, data environment and policy environment, to Makerspace financial support, with relevant human resources and rational development projects and record passenger service content. Under this type, university libraries need enough human resources, capital and equipment resources, independent guarantee, sustainable operation and comprehensive macro management and organizational capabilities. So that teachers and students from different disciplines and different backgrounds can gather together to explore and share. When encountering knowledge bottlenecks, we can conveniently seek help from the library's literature resources.

B. The Library and the Relevant Departments in the School Work Together to Build a Makerspace

Based on the cooperation of other departments in the school, the creation of a Makerspace is generally supported by the library as the main body, and the other cooperation departments support the creation of the Makerspace. Hackerspace involves a lot of engineering knowledge and experimental instruments such as mathematics, engineering and technology. Such as the library re-purchase of experimental equipment, creating experiment and production environment will undoubtedly to some extent in the consumption of library funds, material and space resources, the rational allocation of resources is not conducive to the school, and the joint design itself has 3D in printing, also equipped with wood and metal processing workshop, laser cutting, CNC system and other heavy equipment production plant bed laboratory, industrial robot design and production, is also, computer programming club, engineering mathematics, or create a passenger space. On the other hand, as a professional discipline department, it can provide users with professional information consultation and knowledge instruction, and it can also save many unnecessary resources for libraries and schools. Therefore, the knowledge interaction between the library and the related departments under the guidance of the library helps to promote the knowledge flow of the whole school, and provide conditions for the emergence of new knowledge and creativity.

C. Joint creation of Makerspace by School Enterprise Cooperation

In March 2016, the United States "Library Journal" editor Meredith Schwartz in "the future" of the library top skills to summarize: the future library top skills including policy, cooperation, communication, creativity, critical spirit, data analysis, scalability, leadership, marketing, project management and technical expertise of eleven. In January 2015, Premier Li Keqiang visited Shenzhen's "Firewood Makerspace". From the national level, we launched the creation of Makerspace into the public view. At the same time, in order to promote entrepreneurship and innovation, the Executive Council of the State Council issued many supporting policies to reduce taxes and reduce costs. To guide the innovation and Entrepreneurship Policy in the country, as one of the incubator Makerspaces, high school library and become blue ocean business innovation block. However, it is difficult for enterprises and university libraries to create a Makerspace alone because of their limited resources and focus on the field of industry. Therefore, the co-creation of school enterprise cooperation is undoubtedly a combination of productivity, market, research and development, intelligence, and project development. On the one hand, it has found a market breakthrough for the research and development ability of university libraries. On the other hand, it also provides a base for the continuous improvement and creation of the technological capabilities of the enterprises,

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and provides a very consistent platform for the integration of the resources between the two sides.

VIII. SUMMARY

"Creation" is the highest level of learning. The University Library bears the sacred duty for the teaching and research service of the school, and it is the second class of students' learning. The introduction of Makerspaces into library, can effectively fill the blank of classroom teaching and extracurricular practice, provide independent choice, more innovative learning opportunities for users, and can re-organize the library service mode, improve service quality and level, and improve the service quality and level of the library, and then improve the influence in schools and libraries in the society.

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