International Journal of Web-Based Learning and Teaching Technologies
Volume 18 • Issue 2

Intelligent Informatization Construction of University Libraries in the Environment of Multimedia Big Data

Nan Pang, North China University of Science and Technology, China*
Charles Crook, University of Nottingham, UK

ABSTRACT

With the advent of the big data internet era, the corresponding multimedia technology is also developing. At the same time, as an important place for students to improve their cognitive level and expand their knowledge coverage, the construction of knowledge and information in university libraries will have an important impact on the growth of students and the development of the library itself. Big data not only brings specific challenges to the intelligent information construction of libraries, but also provides opportunities for the further development of intelligent information construction. Therefore, this paper aims to analyze the intelligent informatization construction of university libraries in the multimedia big data environment, make suggestions for the further development of library intelligent informatization construction, and provide reference materials for library intelligent informatization construction.

KEYWORDS

Big Data Environment, Informatization Construction, Library Management, Multimedia

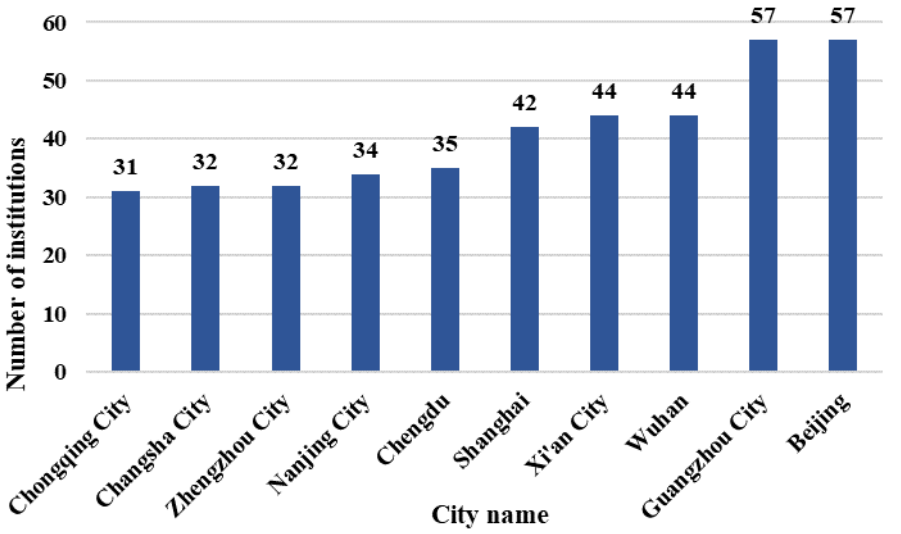
INTRODUCTION

With the rapid development of the Internet and the informatization industry, the data generated by various application fields is rapidly expanding and growing; the importance of data and people's dependence on data are also getting stronger and stronger, and the big data environment will inevitably develop (Chen, 2020). In the context of the informatization environment, the digitization of university library knowledge has ushered in new opportunities and difficulties, and relevant applications and research have also been carried out in the field of university libraries (Huang, 2021). The statistics of ordinary universities with library websites in some parts of the country are shown in Figure 1.

Library intelligent informatization construction involves transforming the traditional library operating mechanism into a modern and advanced system by utilizing informatization technology (Jiahui et al., 2020). This process aims to manage and utilize library literature and informatization resources in a more scientific and effective manner, thereby improving the management level,

DOI: 10.4018/IJWLTT.330244 *Corresponding Author

Figure 1. Statistics of general universities with library websites in parts of the country



informatization development ability, and service level of libraries. In other words, library intelligent informatization construction is about integrating informatization technology into the library's operations to better meet the needs of users in the digital era. At present, China's libraries have made great achievements in the construction of intelligent informatization. For example, the construction of intelligent informatization started from scratch; it started from independence to participation in the Internet and from manual search for informatization to network informatization search.

Judging from the current development of informatization technology, it has gradually changed the production and lifestyle of the masses and improved the management efficiency of various fields, and in view of the informatization management of university libraries, researchers should actively introduce advanced informatization technology, change the current management mode, adapt to the needs of the development of the times, and provide more high-quality services for teachers and students of the whole school. Under the background of big data, university libraries have gradually developed from digital libraries and hybrid libraries to smart libraries, which is the highest form of library development (Shu et al., 2021). With the development and maturity of big data, the physical network, cloud computing, and other technologies, intelligent devices have become widely used, and smart libraries have good development support. Big data technology has allowed libraries to intelligently manage their informational resources, users, and administrative functions, leveraging its advantages effectively.

In recent years, with the rapid development and wide application of big data, cloud computing, artificial intelligence, and other technologies, the service means and methods of all kinds of libraries at all levels have been increasingly developing in the direction of intelligence, which has also set off a wave of library intelligence research. For example, some scholars conducted in-depth analysis on the development trend of university libraries under the background of big data and put forward their own opinions on the construction of smart libraries (Jing, 2021). Some scholars elaborated the concepts of smart library and big data, analyzed the necessity of the construction of university smart libraries, and proposed specific measures (Liu, 2020). Some scholars have discussed and analyzed the reasons that affect the construction of university smart libraries and proposed to realize the intellectualization of university libraries from such dimensions as yjiuconcept, technology, and service (Hou, 2020). In order to solve the problem of users' personalized needs in smart libraries, some scholars put forward

the framework and model of library readers' personalized service needs (Zhang, 2021b). Under the background of big data and multimedia, great changes have taken place in the resource structure, management mode, service mode, technology application, user needs, etc. of university libraries.

This article analyzes the basic characteristics and construction content of smart libraries in the era of big data, summarizes the current situation of construction in college and university libraries, identifies existing problems, and proposes countermeasures to strengthen the integration of informatization management and emerging intelligent technologies in library construction. The article suggests upgrading resources, services, technology, and librarians to integrate emerging intelligent technologies into library construction. The study uses situation investigation and literature research methods to explore the intelligent construction of university libraries under the multimedia big data environment. Situation investigation involves interviews with university library staff to understand the challenges faced in informatization resource development and utilization, while literature research involves analyzing works by relevant scholars, consulting academic journals, and searching databases to collect and analyze research results and form the Nan Pang's and Charles Crook's views on the topic.

With the increasing demand for personalized services, the traditional library service mode is no longer sufficient. A smart library that integrates modern informatization technology and intelligent management services has become essential. Therefore, it is necessary to study how university libraries can be built intelligently in the multimedia big data environment. This paper analyzes the basic characteristics and construction contents of the smart library in the context of the big data era. It also investigates the current construction status and challenges faced by smart libraries in colleges and universities. The paper proposes that college library smart construction should focus on strengthening the deep integration of informatization management and emerging intelligent technologies. In this study, the situation investigation method is adopted. Interviews and discussions with university library staff are utilized to identify the problems and obstacles encountered in university library practices, which is crucial for obtaining relevant informatization.

MULTIMEDIA AND BIG DATA

Multimedia

Multi-media is a new media tool gradually formed in the trend of the era of big data, including various websites and electronics email, search website, chat software, online mobile games, Weibo, online news, online media, smart TVs, 5G networks, movies, etc. (Zhang, 2021a). In the process of communication, the barriers between the media are often broken (Xue et al., 2021). It is embodied in the following three representative characteristics:

1. Originality in content. The typical feature of multimedia is that the original multimedia has almost no user access restrictions, so most people can participate in the creation of multimedia content (Chen et al., 2021).
2. Interactivity in communication. The interaction and communication between multimedia publishers and viewers are very convenient and frequent, and Internet users are not only browsing web content but are also creators of web content (Shu, 2021). Compared with traditional media, the establishment of multimedia communication platforms makes communication faster and smoother. The communication between the audience and the creator is deeper, and the audience can respond to the creator's comments and feedback on the work in a timely manner (Liu, 2018). This is an advantage that traditional media does not have.
3. Time-on-time time. The multimedia publishing process can realize real-time publishing with relatively small reception time limits and relatively small-time delays. In traditional media releases, radio and television programs are often habitually referred to as programs because they often require pre-set steps and proper planning. However, multimedia publishing is almost

unrestricted by time and space and has a strong randomness (Xiao, 2022). After analyzing the characteristics of multimedia, the author concludes that in order to effectively utilize its advantages and mitigate potential threats, university libraries will continuously enhance their ability to respond to challenges.

Big Data

As computer technology is fully integrated into social life, explosive informatization begins to accumulate and change. Big data is not something new that comes from nowhere. In 1980, the famous American thinker and futurist master Alventovler first proposed the concept of "data" and "big data" in *The Third Wave* (Wang & Sha, 2021). The book boldly shows that not only is data seen as wealth, but that big data will also be the highlight of the third wave of the revolution. Gartner, a big data research group, defines "big data" as a large-scale, high-growth multiple informatization asset that requires new processing models with more powerful decision making, discovery insights, and process optimization capabilities (Aiqun, 2018).

Big data has increasingly become an indispensable strategic resource, an important means for countries to promote economic development and national governance, and the global big data fever has become a new trend in the development of the times (Zhang, 2019). Big data is a collection of data characterized by large capacity, diversity, high-speed access, and high utilization value and is an important production factor and informatization asset in modern society. Big data technology is a comprehensive informatization processing technology that can effectively mine, integrate, and analyze a large number of distributed structured, unstructured, and semi-structured data informatization (Zhao et al., 2018). This process effectively enables decision-making, insights, and process optimization of topics as well as continuous value addition of business value and service functions. As a breakthrough technology generated in the Internet environment, big data takes technology as the fulcrum to promote the comprehensive change and upgrading of thinking mode, operation concept, solution, service method, and business model, and maximize the change of the entire society Nowadays, big data has been fully integrated into all aspects of socio-economic and public life and has become an important driving force for the reform and improvement of cultural education, medical care, business innovation, government governance, and people's life services. In the field of public culture, big data will have a comprehensive impact on the construction of intelligent informatization of libraries. A large number of literature data resources, large-scale user informatization, various types of library collection resources, and diversified user demand informatization together constitute the big data environment of university libraries in the new era, which just fits the "4V" characteristics of big data and provides the possibility for university libraries to promote the personalization, diversification, and initiative of knowledge services.

INTELLIGENT INFORMATIZATION MANAGEMENT OF UNIVERSITY LIBRARIES

The Significance of Intelligent Informatization Management of University Libraries

Intelligent informatization management of university libraries is helpful to improve the efficiency of informatization management. In the context of the big data environment, the informatization of college library materials is gradually diversified, and at the same time, with the popularization of informatization technology, the storage method of library materials has gradually changed from paper materials to electronic materials (Tang & Hu, 2021). In order to effectively improve the efficiency and level of case book management, it is necessary to recognize the important role of informatization management, prove the advantages of informatization management, and enable library management departments to adapt to the actual needs of intelligent informatization construction (Zhang et al., 2018). Colleges and universities should attach importance to the intelligent informatization construction of libraries, and combine the actual situation of library operation, introduce advanced informatization

technology, and rationally apply it, so as to improve the degree of informatization of libraries, so as to promote the stable development of university libraries. The objectives of the construction of the functions of the university are shown in Figure 2.

Intelligent informatization management of university libraries is helpful to reduce management cost. In the process of managing library materials, since there are almost all Paper Books, the work of keeping relevant book informatization requires a lot of labor, and the burden on the staff will also increase. However, in the context of the big data environment, the most important advantage is that the cost of library management is reduced by making library management more efficient and by saving book storage space (Li et al., 2021). The preservation of informatization resources can be improved by improving the management of books and the use of informatization technology in storage. The informatization resource types are shown in Table 1.

Problems in the Intelligent Informatization Management of University Libraries

(1) Lack of standardized management system. The current management process of many colleges and universities has introduced informatization technology related to library management, but combined with the actual situation of library management, a more scientific and reasonable electronic data management mechanism has not been formulated (Liang, 2022). The lack of standardization and rationality of the management mechanism is not conducive to improving the actual efficiency of library management. In the process of sorting out electronic data, managers usually classify and manage a large number of books and materials, but in the process of specific numerical management and collection, it is impossible to effectively manage books due to the simple limitations of the management mechanism. Problems with not being able to identify

Figure 2. Objectives of the construction of university functions

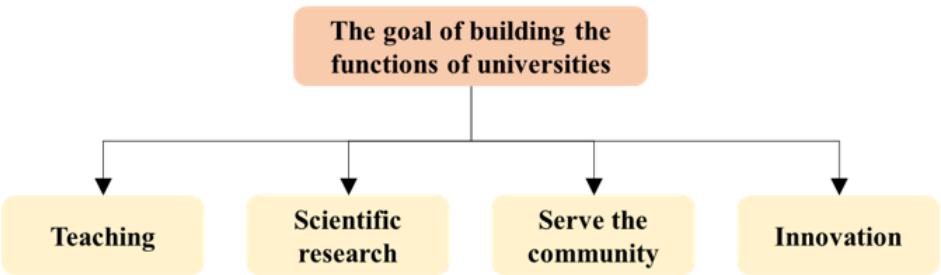


Table 1. Informatization resource types

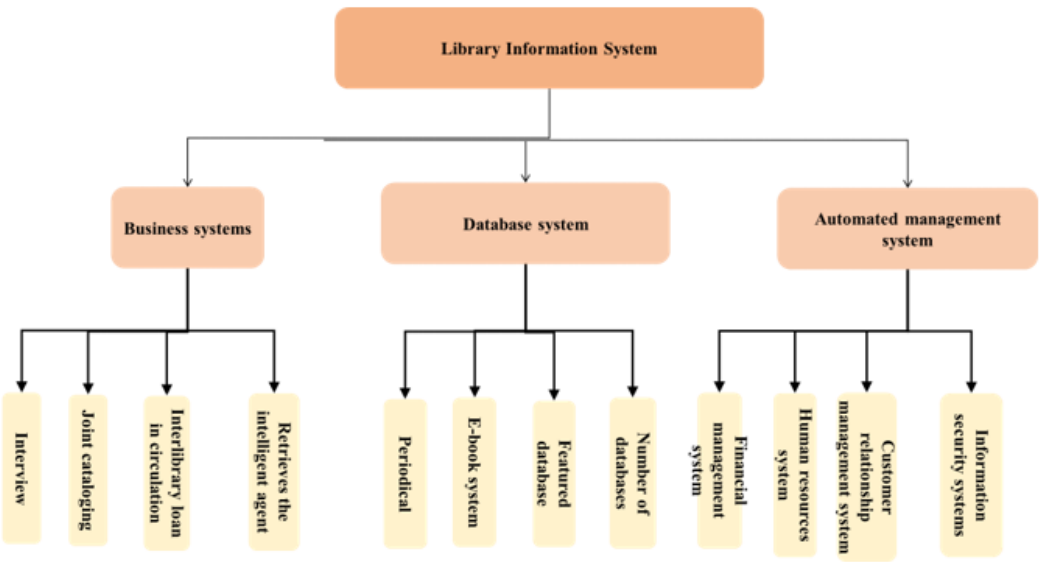
The Informatization Resource Type	Record Form	Peculiarity	How It Exists
Collection informatization resources	Writing, printing, panning, digitizing	Scientific	Books, periodicals, newspapers, research reports, conference materials, academic papers, government publications, e-books and periodicals, databases
Network informatization resources	Quantification	Rich, good, and bad	Informal publication informatization, semi-formal publication informatization, formal publication informatization
Potential informatization resources	People are stored in the brain during cognition and creation	Easy to forget, unable to be directly used, with hidden characteristics	Thoughts, skills, experiences, opinions, etc

electronic data can lead to incompleteness and inaccuracy of the data collection process and pose specific management risks. The composition of the library informatization system is shown in Figure 3.

(2) The digital management method is relatively single and lacks a high degree of management concept. In the process of library management in colleges and universities, it is necessary to conduct detailed investigation and analysis in combination with the relevant characteristics of library materials, expand the current management channels, innovate and upgrade the current management methods, and meet the actual needs of current administrators (Qian et al., 2021). In practice, managers spend a lot of effort on investigating data and need to collate and archive all kinds of valid informatization in a timely manner, so the work of staff is more stressful. Although the current university library has improved the utilization rate of digital management, it cannot make full use of the benefits of digitalization. Judging from the current situation of informatization management, it is very difficult to improve the level of intelligent informatization construction without establishing a correct management concept. Under normal circumstances, administrators can use informatization technology only to easily process data and cannot integrate advanced management concepts into the various processes of library management (Ma, 2022). In the standardization and processing of informatization management, manual methods are still used as the main management means, resulting in waste of resources and making it difficult for informatization management to achieve orderly development.

(3) Management personnel lack high comprehensive ability. In the process of university library management, library managers, as the protagonists of data management, should adapt to the needs of today's society and strengthen the requirements for their own capabilities, so as not to be squeezed out by fierce market competition. The professional level and comprehensive quality of librarians directly affect the actual efficiency of management work, but from the current management situation, the work behavior of administrators cannot be restricted by stricter requirements, so it is difficult to improve informatization efficiency. Many operators are highly professional, but their inability to use informatization technology wisely prevents operators from improving their level of informatization operations. In the process of recruiting operators, the library focuses only on the inspection of academic qualifications and basic knowledge and does

Figure 3. Composition of the library informatization system



not strengthen the inspection of professional ability and comprehensive quality, which is difficult to adapt to the actual needs of colleges and universities. In addition, strict and conservative management models and management methods are difficult to adapt to the continuous progress and innovation of informatization technology and concepts. University libraries should focus on the follow-up and training of management personnel and regularly carry out professional training in accordance with the current new situation, new technologies, and new requirements for improving the level of library informatization management. The staff will provide better services for the intelligent informatization construction of library management.

EFFECTIVE SOLUTIONS FOR THE INTELLIGENT INFORMATIZATION CONSTRUCTION OF UNIVERSITY LIBRARIES IN THE ENVIRONMENT OF BIG DATA

Establish a Complete Informatization Resource Sharing Platform

In the current big data environment, if domestic institutions want to promote the efficiency of libraries through informatization processing modes and meet the actual reading needs of teachers and students in schools, the use of big data Internet technology can be implemented to create relevant informatization exchange platforms; however, performing this work requires the involvement, coordination, and collaboration of multiple stakeholders to ensure the effectiveness of the shared platform building. Based on this, universities will apply big data technology to the construction of informatization sharing platforms to improve the degree of informatization of libraries (SSivankalai, 2021). For example, when implementing intelligent informatization construction, university libraries can strengthen cooperation with relevant local libraries, use advanced informatization technology to create communication platforms, and make the intelligent informatization construction of knowledge bases more standardized and complete. When colleges and universities implement intelligent informatization construction, they must fully understand the specific needs of relevant listeners. For example, single-subject and comprehensive universities could use informatization technology to open the official websites of libraries. In this way, readers could browse the official website and keep track of book resource informatization at any time. The status of some of the manifestations of educational functions in university libraries is shown in Figure 4.

As a center for the collection and distribution of knowledge and informatization resources, libraries are an important place to enrich people's spiritual and cultural life and improve people's ideological and cultural literacy. A library utilizing big data technology will become a new resource gathering place in the future that integrates big data storage, integration, analysis, and application. Therefore, the current construction of library resources requires the use of Internet informatization technology and cloud storage technology on the basis of existing library resources, and the network resources closely related to library resource plans are included in their own digital resource categories and are constantly expanding. The collection informatization resource model is shown in Table 2.

The library's data collection boundaries form a new resource model for sharing informatization across the Internet, enabling the infinite expansion of virtual resources. In addition, in order to further address the issue of limited resources, libraries should adhere to the concepts of openness and sharing and strive to promote resource sharing among libraries and the openness of data resources. In addition, in order to achieve the true informatization of libraries, cooperation between libraries and the sharing of resources are key. Today, when all resources are interconnected and shared, the resource construction of a single library must form a link and interoperability model with the resource construction of the National Library. Therefore, based on the concept of openness and sharing, libraries should abandon the independent work of establishing intelligent informatization, making full use of the latest database technology to enhance and maximize resources and services with local

Figure 4. Status of some forms of educational function in university libraries

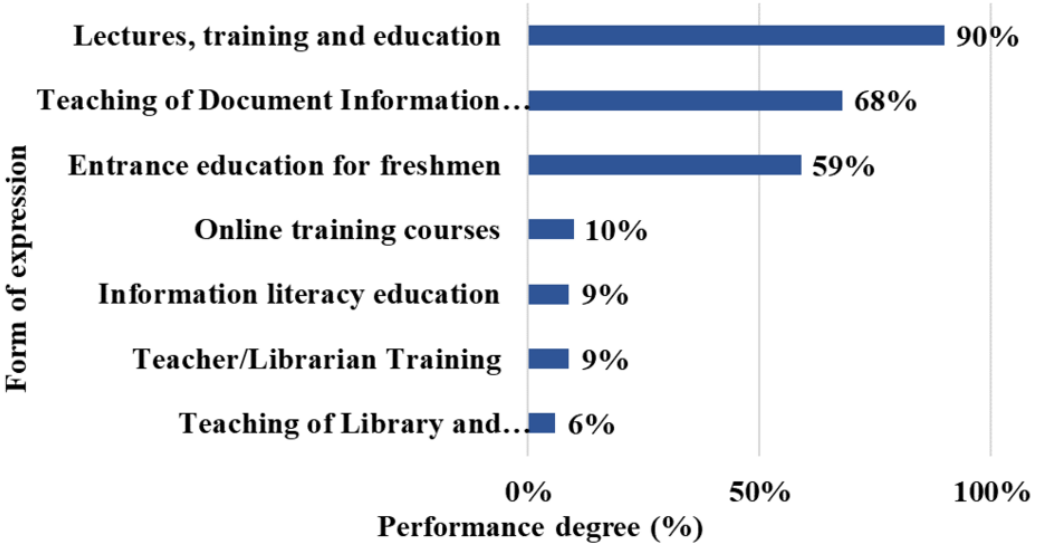


Table 2. Collection informatization resource model

The Informatization Resource Type	Storage Form	Key Features	The Primary Carrier
Collection informatization resources	Printed, miniature, written, acoustic, digital	Strong scientificity	Newspapers, books, research reports, conference materials, academic papers, publications, databases, etc.
Network informatization resources	Digitized and electronic	Resources are abundant and uneven	Informal publication informatization, semi-formal publication informatization, formal publication informatization
Potential informatization resources	Human cognition and innovation process in the brain	Not directly usable, implicit, forgettable	Thoughts, skills, experiences, and perspectives are more accessible during exchange and discussion

and national libraries. Massive resource expansion and service expansion make libraries a treasure trove of data interconnection and large-scale human data resources.

Improve the Intelligent Service Level and Comprehensive Capabilities of the Museum

In the context of the informatization age, the digital construction of university libraries is meeting new opportunities and challenges. In order to build an intelligent information library that meets the needs of social development, it is necessary to face difficulties, expand the capacity of the library, improve the service level of the library, and attach importance to and strengthen the cultivation of the comprehensive quality of librarians. In addition, librarians also need to obtain real-time information on resource informatization. For example, a single-disciplinary university or comprehensive university can build a smart customer service platform for libraries, allowing readers to access websites to query book resources and improve the overall service level of the university by reducing the time spent searching for resources. Traditionally, the scope of the position of university librarian has

been relatively narrow; the librarian was mainly responsible for the distribution of documents, the classification and cataloguing of books, etc., which is a relatively passive position. In the context of big data, the role of university librarians has also been affected to some extent, most notably in terms of functional changes. This change has certain requirements for the manager's own management ability, computer operation ability, informatization processing ability, etc.

University library managers should actively change their thinking in accordance with the basic requirements of big data; adhere to the people-oriented, emotional masses; change the concept of traditional passive services; and enhance their awareness of big data and informatization services. Therefore, librarians must establish a service awareness of "service first, user first," pay attention to communication with users, and provide personalized services. The second is the improvement of big data capabilities. Library administrators should have a good sense of service, so it is necessary to appropriately improve the ability of big data. On the one hand, colleges and universities need to improve the comprehensive operation ability of library-related businesses; on the other hand, they need to regularly train operation talents to improve their computer operation capabilities and the ability to use Internet resources. In the daily business process, one can use seminars, lectures, and outbound exchanges to improve one's abilities and skills. In addition, relevant experts can also be hired to teach skills and knowledge in schools so that administrators have a deeper understanding of the intelligent informatization construction of library management under big data.

Cultivate Readers' Awareness of Informatization and Do a Good Job in Publicity

In today's fiercely competitive era, many universities have shifted their talent cultivation goals from cultivating single talents to cultivating composite talents, requiring students to not only learn solid basic knowledge but also learn more skills. In addition, university libraries need to cultivate readers who can centrally search for information technology. For example, assigning full-time librarians for freshman training, offering courses related to literature retrieval, and improving students' learning enthusiasm and book usage efficiency. The characteristics and causes of reader behavior in Chinese university libraries are shown in Table 3.

Review behavior is concentrated in the homework process, as the purpose determines the direction of reading. If the reading behavior does not achieve the original reading purpose, readers should adjust or take a new reading behavior. Due to schedule, borrowing and reading mainly occur after or before class, as readers' behavior and the library environment interact. Changes in the library environment can cause changes in readers' reading, and readers can adjust their behavior accordingly. Self-study occurs in the library reading room because reading needs come from diverse factors, such as personality, attitudes, and motivations. Readers' behavior is a continuous process of knowledge accumulation, requiring perseverance to achieve a reading purpose.

Countermeasures to promote the intelligent informatization construction of university libraries under the multimedia big data environment include:

Table 3. Characteristics and causes of reader behavior in Chinese university libraries

Behavioral Characteristics	Genesis
The act of retrieval is temporary	The review behavior is mostly concentrated in the course of coursework
Borrowing behavior is centralized	Due to the class schedule, borrowing is mostly concentrated in the time period before the after-school class
Learning behavior is retention	Self-study and other behaviors occur in large numbers in the library's reading room and occupy seats for a long time
There is diversity in search behavior	The informatization can be accessed through the Internet or through informatization retrieval in the library

1. Building a new service mechanism with personalized needs, using informatization technology to actively understand and explore users' needs, and improving users' satisfaction.
2. Using big data to effectively manage data resources and transform traditional space into informatization space, improving users' satisfaction with the library space experience.
3. Introducing intelligent technology in book borrowing and informatization consulting services, such as self-help borrowing and the returning of books, self-help answering of simple questions, and spatial intelligent reservation management.
4. Customizing and expanding original tools, improving the intelligence of library functions, and providing technology training to improve librarians' new technology literacy and promote overall intelligent development of the library.

CONCLUSION

This paper analyzes the characteristics and construction of smart libraries in the era of big data and proposes that the construction of smart libraries in colleges and universities should integrate informatization management and emerging intelligent technologies. To achieve this, universities should improve their library service system, enrich smart services, integrate data resources, share service resources, and strengthen the librarian talent team. To carry out this construction, universities must innovate the service mode, improve digital resource construction, establish an intelligent informatization processing system, and meet the diverse needs of users with personalized informatization services. This will inject new vitality into the development of libraries.

DATA AVAILABILITY

The figures and tables used to support the findings of this study are included in the article.

STATEMENT OF COMPETITIVE INTEREST

The authors declare that they do not have competitive interests.

FUNDING STATEMENT

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. Funding for this research was covered by the authors of the article.

ACKNOWLEDGMENT

The authors would like to show sincere thanks to those whose techniques have contributed to this research.

REFERENCES

Aiqun, Z. H. U. (2018). An IT capability approach to informatization construction of higher education institutions. *Procedia Computer Science*, *131*, 683–690. doi:10.1016/j.procs.2018.04.312

Chen, L. (2020). Analysis of the informatization construction of library. *Journal of Physics: Conference Series*, *1486*(2), 022009. doi:10.1088/1742-6596/1486/2/022009

Chen, Z., Zhou, M., & Feng, L. (2021). Analysis of the smart library construction in colleges based big data and artificial intelligence. *Journal of Physics: Conference Series*, *1955*(1), 012017. doi:10.1088/1742-6596/1955/1/012017

Hou, D. (2020). Research on the remoulding of reader service mode in smart library. *Frontiers in Business. Economics and Management*, *1*(1), 1–5.

Huang, W. (2021). Design of intelligent recommendation system of smart library under big data environment and its application research in applied university. In *Emerging Trends in Intelligent and Interactive Systems and Applications: Proceedings of the 5th International Conference on Intelligent, Interactive Systems and Applications (IISA2020)* (pp. 628-634). Springer International Publishing.

Jiahui, L., NingXing, W., & Chao, D. (1606). NingXing, W., & Chao, D. (2020). The design of smart library based on 5G. *Journal of Physics: Conference Series*, *1606*(1), 012011. doi:10.1088/1742-6596/1606/1/012011

Jing, Z. (2021). Application of data mining based on computer algorithm in personalized recommendation service of university smart library. *Journal of Physics: Conference Series*, *1955*(1), 012008. doi:10.1088/1742-6596/1955/1/012008

Li, T., Tang, J., Xiao, L., & Cai, M. (2021). Evaluation of smart library portal website based on link analysis. *Procedia Computer Science*, *188*, 114–120. doi:10.1016/j.procs.2021.05.059

Liang, Y. (2022). Study on library big data literature service scheme of big data colony algorithm. In *The international conference on cyber security intelligence and analytics* (pp. 599–605). Springer. doi:10.1007/978-3-030-97874-7_78

Liu, Y. (2018). Research on the application of big data in academic libraries. In 2018 international conference on intelligent transportation, big data & smart city (ICITBS) (pp. 364-367). IEEE. doi:10.1109/ICITBS.2018.00099

Liu, Y. (2020). Survey of intelligent recommendation of academic informatization in university libraries based on situational perception method. *Journal of Education and Learning*, *9*(2), 197–202. doi:10.5539/jel.v9n2p197

Ma, L. (2022). Research on the construction of "5G+ smart library" comprehensive management system. *Second International Conference on Sensors and Informatization Technology (ICSI 2022), 12248*, 250-255. doi:10.1117/12.2637521

Qian, Y., Xing, Z., & Shi, X. (2021). From collection resources to intelligent data: Construction of intelligent digital humanities platform for local historical documents of Shanghai Jiao Tong University. *Digital Scholarship in the Humanities*, *36*(2), 439–448. doi:10.1093/llc/fqaa027

Shu, Z. (2021). Research on the characteristics and guarantee system of smart library. In 2021 international conference on Internet, education and informatization technology (IEIT) (pp. 195-198). IEEE. doi:10.1109/IEIT53597.2021.00049

Shu, Z., Jiang, Y., Liu, J., & Wang, M. (2021). Analysis of mobile push service model of smart library based on big data. *Journal of Physics: Conference Series*, *1883*(1), 012055. doi:10.1088/1742-6596/1883/1/012055

Sivankalai, S. (2021). The impact of Cloud computing on academic libraries. *Library Philosophy and Practice*, *9*(3), 1–17.

Tang, B., & Hu, B. (2021). Design of digital library data search engine based on Cloud computing in big data era. *Journal of Physics: Conference Series*, *2037*(1), 012137. doi:10.1088/1742-6596/2037/1/012137

Wang, C., & Sha, Z. (2021). Research on intelligent informatization system of library under big data and digitization technology. *Journal of Physics: Conference Series*, *2083*(4), 042063. doi:10.1088/1742-6596/2083/4/042063

Xiao, N. (2022, January). The Construction Path of University Smart Library Based on Digital Twin. In *2022 2nd International Conference on Consumer Electronics and Computer Engineering (ICCECE)* (pp. 35-38). IEEE. doi:10.1109/ICCECE54139.2022.9712798

Xue, J., Wang, Y., & Wang, M. (2021). Smart design of portable indoor shading device for visual comfort—A case study of a college library. *Applied Sciences (Basel, Switzerland)*, *11*(22), 10644. doi:10.3390/app112210644

Zhang, H., Lin, P., & Li, X. (2018). The construction of university's smart Library. In Asia-Pacific social science and modern education conference (SSME 2018) (pp. 12-15). Atlantis Press. doi:10.2991/ssme-18.2018.3

Zhang, J. (2021a). Innovative service mode of smart library in 5G era. *International Journal of Frontiers in Sociology*, *3*(1).

Zhang, L. (2021b). Exploration on smart library construction in 5G era. *Journal of Physics: Conference Series*, *1952*(4), 042040. doi:10.1088/1742-6596/1952/4/042040

Zhang, Y. (2019). A discussion on the service system of college smart libraries in the "Internet+" age. *Journal of Physics: Conference Series*, *1345*(5), 052011. doi:10.1088/1742-6596/1345/5/052011

Zhao, J., Cai, W., & Zhu, X. (2018). Research on smart library big service application in big data environment. *International Symposium on Computational Science and Computing*, 238-245.