Research on the Construction of Library Digital Culture Service Models in the Metaverse Context

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Abstract

With the advent of the metaverse era, university libraries, as centers for knowledge dissemination and academic research, will face new challenges and opportunities in digital cultural services. This paper adopts the metaverse perspective as a framework, analyzes the impact of the metaverse on digital cultural services and the current state of digital humanities services in university libraries, explores the model construction of digital cultural services, and proposes recommendations for further improvement and development.

Full Text

Research on the Construction of Digital Cultural Service Models for University Libraries from the Metaverse Perspective

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Abstract: With the advent of the metaverse era, university libraries, as centers for knowledge dissemination and academic research, will face new challenges and opportunities in digital cultural services. This article adopts the metaverse perspective as its framework to analyze the impact of the metaverse on digital cultural services in university libraries and examine the current state of digital humanities services. It explores the construction of digital cultural service models for university libraries and proposes recommendations for further improvement and development.

Keywords: Metaverse; university library; digital cultural services; user experience
Classification Number: G252

With the rapid development of information technology and the arrival of the digital age, university libraries, as centers for knowledge dissemination and academic research, are encountering new challenges and opportunities in digital cultural services. The "Metaverse," as an extension of virtual reality and augmented reality technologies, provides a novel perspective and innovative ideas for digital cultural services in university libraries. This study aims to investigate the construction of digital cultural service models for university libraries through the lens of the "Metaverse," thereby enhancing user experience, expanding service scope, and adapting to the evolving demands of contemporary academic needs.

The term "Metaverse" was first used in 2021 by the online game creation platform Roblox. The Metaverse represents a vast virtual space constructed through virtual reality and augmented reality technologies—a simulated digital universe that can interact with the real world. Specifically, it refers to a multi-user shared virtual space containing various forms of digital information, artificial intelligence, objects, and environments. Users can interact and experience this space in an immersive manner, characterized by virtuality, interactivity, diversity, shareability, and cross-platform compatibility. The Metaverse is a virtual world that simulates reality or creates entirely new fictional environments through computer-generated graphics and scenes. It encompasses diverse content types, enabling users to collaboratively create, share, and exchange content within it, thereby achieving interactive experiences of cooperation and collaboration. Unconstrained by specific hardware devices or operating systems, the Metaverse can be accessed and experienced through various terminal devices. As a digital space with tremendous potential and possibilities, it offers users entirely new experiences and interaction methods, with broad application prospects across numerous fields. As a digital space constructed through virtual reality and augmented reality technologies, the core technologies of the Metaverse primarily include virtual reality technology, augmented reality technology, 3D modeling and rendering technology, network communication and data transmission technology, and artificial intelligence technology [**?**].

The Impact and Significance of the Metaverse on University Library Digital Cultural Services

With the widespread application of digital libraries and online information resources, the expansion of future library functions and service transformation has become increasingly urgent [**?**]. The Metaverse provides university libraries with broader development space and innovative opportunities. It drives university libraries into the digital age, expands resource scope, improves user experience, promotes academic cooperation and exchange, and advances learning and cultural inheritance and innovation, thereby exerting profound influence and significant importance on university libraries.

2.1 Expanding the Boundaries of Academic Resources

The Metaverse provides university libraries with unlimited virtual space, removing physical constraints on academic resources. University libraries can digitize traditional physical collections and place them within the Metaverse, thereby extending the boundaries of academic resources. Whether on campus or in remote learning environments, users can access rich academic resources anytime and anywhere.

2.2 Providing Immersive Learning Experiences

The Metaverse enables university libraries to create immersive learning environments. Through virtual reality (VR) or augmented reality (AR) technologies, users can enter virtual library spaces to conduct academic research, browse resources, and participate in academic activities within this interactive environment. Immersive learning experiences can enhance users' learning interest and engagement, thereby improving academic experience and effectiveness.

2.3 Promoting Academic Collaboration and Exchange

The Metaverse creates more convenient and interdisciplinary platforms for academic collaboration and exchange. Through virtual meeting rooms, online lectures, academic exhibitions, and other formats, university libraries can facilitate cross-disciplinary cooperation and knowledge sharing among students, faculty, and researchers. Open academic exchange helps stimulate innovative thinking, advance academic research progress, and strengthen the cohesion of academic communities.

2.4 Personalized Services and Intelligent Recommendations

The Metaverse also provides opportunities for personalized services and intelligent recommendations in university libraries. Based on users' interests, preferences, and academic needs, libraries can utilize advanced data analytics and machine learning algorithms to provide customized resource recommendations and academic support. Such personalized services can enhance user satisfaction and effectiveness, enabling more precise information retrieval and academic support. The impact and significance of the Metaverse on university library digital cultural services lie in broadening the scope of academic resources, providing immersive learning experiences, promoting academic collaboration and exchange, and offering personalized services and intelligent recommendations. University libraries can actively leverage the advantages of the Metaverse to continuously innovate and improve digital cultural service models, thereby meeting users' diverse academic needs and enhancing user experience.

Current Status of Digital Cultural Services in University Libraries in the Metaverse Era

Under the Metaverse perspective, digital cultural services in university libraries are in a continuous state of development and exploration. Many university libraries have begun to recognize the importance of digital transformation and have implemented various measures to provide better digital cultural services. However, since most ordinary university libraries are still in the initial stages of digital cultural services, several problems remain.

3.1 Low Quality of Digital Collection Resources

Library digital cultural construction requires support from various digital resources. Although university libraries are actively promoting the digital transformation of their collections and continuously enriching digital resources—including e-books, journal databases, and academic papers—compared to traditional library collections, only a few 211 and 985 university libraries provide digital collections that can be accessed anytime and anywhere, facilitating academic research and teaching activities. Most ordinary university libraries still suffer from low-quality digital resources. First, in the process of constructing and improving digital resources, there is a lack of effective integration and utilization of local resources. Resource procurement is overly passive, relying primarily on external purchases, which easily creates blind spots in digital resource construction. Second, current libraries independently procure databases without interlibrary cooperation, resulting in redundant construction of the same type of databases, with repurchase rates reaching over 90% in some regions.

3.2 Low Utilization of Online Reading Platforms

Many university libraries have established online reading platforms that provide online reading services for e-books and journals, enabling faculty and students to browse and borrow electronic resources anytime and anywhere through library websites or mobile applications. However, utilization rates remain low.

3.3 Remote Access Services Require Improvement

The speed and extent of development under the Metaverse perspective vary. Although many university libraries provide remote access services, enabling faculty and students to use digital resources off-campus, which expands access to information and knowledge and enhances academic research and teaching effectiveness, most libraries still suffer from insufficient personalized digital cultural construction. Resources available on library websites can also be found on the Internet, where information content is often richer and more accessible than that provided by libraries, ultimately resulting in underutilization of library digital cultural resources.

3.4 Lack of Professionalism in Academic Support Services

According to the pace of development under the Metaverse perspective, many university libraries have also launched academic support and guidance services, helping faculty and students with academic research and paper writing through services such as academic writing guidance and literature retrieval assistance. However, due to a lack of professional staff, libraries cannot provide more professional guidance in training, instruction, and activities such as academic lectures and workshops, causing readers to question service quality and resulting in user attrition.

3.5 Lack of Supervision in Data Management and Open Services

University libraries focus on research data management and openness, providing data management tools and resources to support faculty and students in research data collection, organization, sharing, and open access. However, there is also a lack of supervision in service quality systems. The phenomenon of "emphasizing construction while neglecting service" currently exists in most library digital cultural construction. When sharing digital resources, the lack of clear classification and unified naming makes it difficult to retrieve similar resources using consistent subject terms across different libraries. Additionally, library digital cultural services rarely pay attention to content that reflects readers' actual experiences with digital cultural services and user satisfaction, thereby negatively impacting the promotion of library digital culture.

3.6 Continued Need for Innovative Service Practices

Some university libraries have begun exploring the application of Metaverse technologies in digital cultural services, such as virtual libraries, immersive learning, and interactive experiences. These innovative practices provide faculty and students with entirely new learning and research experiences. However, challenges and issues remain, including digital resource copyright protection, data privacy and security, and the digital divide. University libraries need to collaborate with technology providers, copyright institutions, and other stakeholders to address these issues and continuously improve digital cultural services to better meet the academic needs of faculty and students and promote the development of higher education.

Exploration of Digital Cultural Service Models for University Libraries from the Metaverse Perspective

4.1 Digital Resource Display and Dissemination Based on the Metaverse

4.1.1 3D Virtual Exhibitions: Create virtual exhibition spaces through Metaverse platforms to display digital resources in the form of 3D models, im-

ages, or videos. Readers can freely browse and view exhibits in virtual exhibitions and interact with other visitors.

4.1.2 Virtual Reality (VR)/Augmented Reality (AR) Experiences: Utilize VR/AR technologies to present digital resources to readers in an immersive manner. Readers can experience digital resources firsthand, such as viewing artworks in virtual museums, visiting historical scenes, or overlaying digital models onto real environments through AR applications.

4.1.3 Digital Libraries: Create a digital library within the Metaverse to display and disseminate various digital resources, such as e-books, academic papers, and archival documents. Readers can access and utilize these resources through browsing, searching, and downloading.

4.1.4 Virtual Performances and Shows: Conduct cultural activities such as virtual concerts, theatrical performances, and dance shows through Metaverse platforms. Artists and audiences can jointly participate in virtual scenes and interact through audio, video, and other means.

4.1.5 Digital Art Displays: Display digital artworks, creative pieces, and art installations in the Metaverse, allowing readers to appreciate, comment on, and share these works. Additionally, interactive functions within the Metaverse can enable real-time communication and interaction between audiences and artists.

4.1.6 Cross-disciplinary Collaboration and Research: Promote interdisciplinary collaboration and research across various fields through Metaverse platforms. For example, creating virtual laboratories, conference venues, or team workspaces in the Metaverse enables researchers, scholars, and engineers to collaborate, communicate, and explore innovative solutions together.

4.2 Virtual Collaboration and Academic Exchange

4.2.1 Virtual Conferences: Utilize virtual reality technology to create virtual conference venues, enabling researchers to conduct academic exchanges and presentations in virtual environments. Compared with traditional video conferences, virtual conferences can more realistically simulate face-to-face communication and provide participants with more immersive interaction and visual experiences.

4.2.2 Virtual Exhibitions: Create virtual exhibition spaces through virtual reality technology, allowing researchers and scholars to showcase their research findings, academic papers, and innovative projects. Unconstrained by geographical location, virtual exhibitions enable visitors to view exhibitions and interact with exhibits anytime and anywhere, and to discuss and exchange ideas with other participants.

4.2.3 Virtual Laboratories: Utilize virtual reality technology to create virtual laboratories, enabling researchers to conduct simulated experiments, visualized data analysis, and scientific research. Virtual laboratories can provide collab-

orative platforms for interdisciplinary research teams, promoting the sharing of research findings and cooperative innovation. By creating immersive virtual environments and providing enhanced interactive functions, virtual laboratories transform traditional models and limitations, enabling researchers to conduct simulated experiments, visualized data analysis, and academic exchanges and collaboration more conveniently and vividly.

4.2.4 Virtual Communication and Collaboration Tools: Virtual reality platforms can provide various communication and collaboration tools, such as voice chat, real-time collaboration, screen sharing, and whiteboards. These tools enable researchers to easily communicate, discuss, and collaborate in virtual environments, facilitating the development of academic cooperation projects. For example, Peking University Library has launched a "Digital Humanities Research Platform" that integrates various humanities research resources through digital technology and online platforms. Students and faculty can conduct academic research, data consultation, and academic exchanges on the platform, effectively promoting the development and innovation of humanities disciplines.

4.2.5 Virtual Teaching and Training: Utilize virtual reality technology to create virtual classrooms or training scenarios, enabling students and teachers to participate in immersive learning and training experiences. Virtual teaching can provide more interactive and engaging learning methods while supporting cross-regional and cross-disciplinary distance education.

4.3 Digital Collection Construction and Service Innovation

4.3.1 Digital Collection Development: Many university libraries are committed to digitizing paper collections, converting books, journals, newspapers, and other materials into electronic formats through digital technology, and establishing online library platforms that provide search, reading, and download services for electronic resources [**?**]. Through digital collection development, university libraries expand their service scope, actively promote the openness and sharing of academic resources, and provide readers with diverse collection resources for learning, research, and cultural exchange.

4.3.2 Virtual Exhibitions and Cultural Activities: University libraries utilize Metaverse or website platforms to host virtual exhibitions and cultural activities. For example, they arrange virtual exhibition halls to display literature, artworks, or historical relics on specific themes, and organize online lectures, seminars, and cultural activities to attract user participation and enjoyment of cultural feasts.

4.3.3 Open Access Promotion: Some university libraries actively advocate for Open Access, supporting the free acquisition and sharing of academic research findings. They establish Open Access digital repositories and academic journal platforms, providing students, faculty, and researchers with free or low-cost academic resources.

4.3.4 Distance Learning Support: Against the backdrop of the COVID-19 pandemic, many university libraries have strengthened their distance learning support services. They provide online learning resources, instructional videos, e-textbooks, and other materials to help students and teachers conduct remote education smoothly, while also offering online consultation and training services.

4.3.5 Data Management and Research Support: University libraries actively participate in research data management, providing support to researchers in data storage, sharing, and management. They establish data management platforms that offer researchers services including data storage, literature citation, and research collaboration, thereby facilitating the conduct of scientific research. For example, Huazhong University of Science and Technology Library has launched a "Digital Resource Sharing Platform" that integrates digital resources across multiple disciplinary fields. The platform incorporates e-journals, academic papers, dissertations, and technical reports, and provides various search and browsing methods. Readers can search for required academic resources on the platform, facilitating academic research and learning.

Future Prospects for Digital Cultural Service Models in University Libraries from the Metaverse Perspective

5.1 Potential and Challenges of Digital Cultural Service Models in University Libraries

From the Metaverse perspective, digital cultural service models in university libraries possess considerable potential. The Metaverse provides university libraries with a virtual academic space, enabling students and teachers to learn, research, and communicate in entirely new ways. This allows learning resources, library collections, and academic activities to be presented in more interactive and immersive forms, stimulating creativity and collaboration. Simultaneously, it offers opportunities for interdisciplinary cross-pollination and cooperation, enabling collaboration with institutions from other disciplinary fields to share resources and knowledge, thereby promoting disciplinary integration and innovation. Furthermore, students and teachers can participate in cross-disciplinary discussions and collaborations, fostering diverse thinking and creativity. From the Metaverse perspective, various intelligent services can transcend temporal and spatial limitations, enabling broader access to university library digital cultural resources. Readers can experience library services and fully utilize digital resources for academic research and knowledge acquisition through virtual reality technology and online platforms, regardless of their physical location.

However, since digital cultural services in university libraries are still in their infancy and remain in a continuous state of development and exploration, several challenges exist. For instance, implementing digital cultural service models for university libraries from the Metaverse perspective requires support from advanced technology and stable, reliable infrastructure, including high-performance servers, virtual reality, and augmented reality equipment. Univer-

sity libraries need to invest substantial resources to ensure the availability and sustainable development of technology and infrastructure. Additionally, in the Metaverse, readers will interact and communicate with various digital resources, which involves the collection and use of personal data. University libraries must prioritize user data privacy and security protection, implementing appropriate measures to safeguard users' personal information and comply with relevant laws and regulations. Moreover, when providing digital cultural services, university libraries face digital resources of different types and sources, which may involve copyright issues. Libraries need to establish good cooperative relationships with copyright holders and publishers to ensure legal acquisition and use of digital resources, while also addressing issues related to format, standards, and interoperability among different resources.

5.2 Recommendations for Further Improvement and Development

From the Metaverse perspective, the Metaverse brings considerable potential to digital cultural service models for university libraries, but also presents certain challenges. University libraries should focus on overcoming these challenges while actively exploring potential, providing users with more comprehensive, convenient, and innovative digital cultural services, and further improving and developing their digital cultural service models.

5.2.1 Integration of Virtual Reality and Augmented Reality Technologies: University libraries can explore the application of virtual reality (VR) and augmented reality (AR) technologies in digital cultural services. By creating virtual library spaces, students and teachers can browse and access library resources in entirely new ways and interact with digital collections, thereby enhancing user experience and engagement.

5.2.2 Provision of Personalized Recommendations and Intelligent Navigation: With the aid of artificial intelligence and big data analytics, university libraries can develop personalized recommendation systems that suggest suitable academic resources and research literature to readers based on their interests and needs. Simultaneously, introducing intelligent navigation systems can help users quickly locate required resources and information, improving search and browsing efficiency.

5.2.3 Promotion of Social Learning and Collaborative Research: The Metaverse environment provides readers with more open and interactive learning and research spaces. University libraries can build online academic communities to promote communication and collaboration among students and teachers. By organizing online academic lectures, seminars, and group discussions, they can create an atmosphere of academic exchange in the Metaverse, fostering innovative thinking and collaborative abilities.

5.2.4 Introduction of Blockchain Technology to Ensure Information Security: Blockchain technology provides tamper-proof characteristics that can be used to protect the copyright and data security of digital cultural re-

sources. University libraries can consider introducing blockchain technology to ensure the authenticity and credibility of academic papers, research data, and digitized literature, providing readers with reliable academic resources and cultural heritage protection.

5.2.5 Development of Cross-boundary Collaboration and Open Sharing: University libraries should strengthen collaboration with other university libraries, academic institutions, and cultural organizations to share digital resources and service experience. Through open sharing, they can expand library influence and resource coverage, providing quality digital cultural services to more readers.

Conclusion

With the emergence of the Metaverse and the widespread application of digital information resources, the expansion of future library functions and service transformation has become increasingly urgent. Library digital cultural services will also become an important component of library material culture construction. University libraries should proactively adapt to new developments, leverage the advantages of the Metaverse and cutting-edge technologies, further enhance digital cultural service models, provide readers with richer and more convenient academic resources and learning experiences, and meet reader needs in keeping with the times to adapt to the continuously evolving digital era.

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