Metaverse Libraries: The Next Frontier of Information Access and User Engagement

By

Habibu Mukhtar
University Library, Federal University of Technology Babura, Jigawa State, Nigeria

Abstract

The evolution of ICT has transformed libraries from traditional print-based collections to digital systems and now to immersive metaverse environments, where users interact with information through VR, AR, and AI in 3D spaces that enhance engagement, collaboration, and learning. Metaverse libraries enable more active and inclusive information access by allowing users to explore resources via avatars, engage in simulated learning experiences, and connect with others beyond physical boundaries, thereby improving understanding and retention. As such, the study explores the concept and evolution of metaverse libraries in relation to information access, the role of metaverse libraries in enhancing user engagement and supporting immersive learning environments and potential opportunities and challenges associated with the adoption of metaverse libraries. The study used the PRISMA framework to systematically review literature on metaverse libraries and user engagement. A total of 23 sources were retrieved from databases such as EBSCOhost, ProQuest, Google Scholar, and library repositories, but only 13 studies (2023–2026) met the inclusion criteria. The selected studies were analysed to conclude the role, benefits, and challenges of metaverse libraries. The paper concludes that metaverse libraries are a significant development in information retrieval, consistent with STS theory in that they combine technological change with human factors to improve engagement, immersive learning and collaboration. But their use is hindered in developing nations by infrastructure, finance, skills, and ethical considerations, necessitating targeted investment, training and policy to enable their use. The study recommends that metaverse libraries should be phased in with low-level VR/AR and digital technologies and then moved to immersive technologies, particularly in emerging markets. Users and librarians must undergo regular training in VR/AR, AI technologies and digital ethics through workshops, certifications and collaborations. Robust privacy, cybersecurity, accessibility and inclusion policies are critical for ethical use, user safety, and security.

Keywords: Metaverse Libraries, Information Access, User Engagement

Introduction

The evolution of information and communication technologies has continually revolutionised library services, from the early days of printed book collections to modern digital information resources. Recently, the rise of the metaverse has brought about a shift in how users' access and interact with information, from the two-dimensional web-based environments to immersive three-dimensional metaverses. This evolution is in response to the growing need for more interactive, adaptable and user-focused information services in the digital age. Metaverse libraries, therefore, are a monumental leap in library services, allowing users to explore information resources through avatars, explore virtual environments, and connect with others in real time regardless of physical distance (Lim et al., 2026).

Metaverse libraries are built upon the integration of cutting-edge technologies like Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) that collectively offer immersive and interactive learning experiences. These tools allow users to transition from passive to active learning through immersive experiences, such as browsing through virtual bookshelves, interacting with multimedia resources, and conducting simulated learning scenarios such as virtual laboratories and historical reconstructions. These immersive spaces facilitate user engagement by creating more intuitive and experiential learning experiences, which lead to better retention and understanding. Lim et al. (2026) also highlight that the conversion of libraries into metaverse learning commons promotes collaboration and enables innovative teaching and learning beyond physical boundaries.

Beyond improving information access, metaverse libraries play a crucial role in enhancing user interaction through interactivity, collaboration and social engagement. While conventional library systems typically offer users the ability to search and access information, metaverse systems enable users to interact with information and other users in a dynamic and interactive way. This interaction facilitates collaboration and social interaction, key aspects of contemporary education. According to Ajani et al. (2024), metaverse libraries offer opportunities for interactive and personalized information services, allowing librarians to engage with users in real time through avatars and smart systems. Likewise, Adetayo et al. (2023) note that the immersive environment has the potential to attract users and enhance library use, especially among the tech-savvy who are familiar with interactive technologies.

Additionally, metaverse libraries play a role in creating immersive learning environments that cater to various learning styles and foster inclusivity. These environments allow users to interact with three-dimensional representations of complex ideas and engage in hands-on learning experiences, leading to better learning outcomes. Amzat and Adewojo (2023) suggest metaverse-enhanced academic libraries offer a vision of the future of learning, where education no longer takes place within the boundaries of traditional classrooms but in interactive virtual environments. Similarly, Yeganeh et al. (2025) state that metaverse-driven learning models support inclusive learning by catering to diverse learning styles and ensuring equal access to learning resources.

The global rollout of metaverse libraries shows a digital divide between developed and developing regions of the world, with developed countries leading the adoption of metaverse libraries as a result of their advanced technology infrastructure, funding and readiness. Metaverse technologies such as virtual reality (VR), augmented reality (AR) and 3D immersive technologies have already been widely adopted for user services in academic and public libraries in the United States and some European countries. For example, it has been found that 86% of top U.S. university libraries

are using VR/AR technologies for immersive user services, virtual exhibitions and digital reference services (Guo et al., 2024). Similarly, in city libraries in the U.S., the adoption of VR/AR technologies (76%) and 3D technologies (84%) for user services such as virtual tours and 3D printing is high (Savaşkan, 2024). Similarly, the metaverse is also actively being adopted in Europe and other developed regions, as part of smart libraries which enhance "living libraries" and user engagement, with institutional investment in immersive learning environments (Laybats & Tredinnick, 2023; Liu & Tinmaz, 2024).

These observations show the advanced regions are rapidly embracing the metaverse in libraries to improve access, engagement and interactive learning. In contrast, metaverse libraries in developing areas are still in their early stages of implementation, largely due to lack of infrastructure, funding and capacity. There is awareness but low adoption with libraries still predominantly operating on traditional or semi-digital platforms. Research indicates that lack of adequate ICT infrastructure, lack of funding and low level of digital literacy among librarians are still barriers to its adoption in developing countries (Ajani et al., 2024; Adetayo et al., 2023). However, there is also growing interest in other regions such as Asia and some African countries where research shows that more than 50% of librarians and users are positive about the adoption of the metaverse, but it is not fully adopted due to lack of resources (Subaveerapandiyan, 2025; Thus, while the metaverse library is being used in developed regions, it is still in the preliminary and experimental stages in developing regions, showing a digital divide in the future of libraries.

While this has many benefits, there are also challenges associated with the use of metaverse libraries. A key challenge is the cost of building the technological infrastructure required. To implement immersive technologies, significant investments are needed in hardware, software and network infrastructure, which may not be affordable for all institutions, especially in developing countries. According to Pandey and Pandey (2025), although the metaverse holds great potential for libraries, the realisation of this potential is constrained by financial and technological barriers, which must be overcome through strategic planning and investment. Data security and privacy is another major concern. Metaverse platforms leveraging artificial intelligence and immersive technologies require the gathering and processing of substantial amounts of user data, giving rise to concerns about data security and ethical considerations. Oladokun et al. (2024) stress that the metaverse has cybersecurity concerns such as identity theft and data breaches that pose a threat to users and organizations. This calls for strong security policies and ethical considerations to safeguard the safe and ethical use of metaverse technologies in libraries.

Additionally, digital divide is a significant challenge to metaverse library implementation. Although these technologies can improve worldwide access to information, disparities in access to digital technologies and the internet could restrict its benefits. Ajani et al. (2023) stress that without inclusive policies and strategies, the implementation of metaverse technologies could result in a digital divide instead of inclusion. So, we need to meet the challenge of access and digital inclusion in designing the metaverse library systems.

Moreover, the shift towards metaverse libraries requires the development of new skills and competencies for librarians and users. The notion of metaliteracy takes on new significance, as users need to learn to navigate, assess and produce information in immersive environments. Laybats and Tredinnick (2023) point out that the use of augmented and virtual realities in libraries requires a rethink of existing information literacy models to support immersive technologies. Metaverse libraries are a revolutionary concept in library and information science, which provide new opportunities for improving information access, user engagement and immersive learning.

Yet, the adoption of these systems must be approached with consideration of the potential challenges, such as cost, security, digital divide and new skills. As a result, this paper aims to examine the concept and development of metaverse libraries in terms of information access, to evaluate their impact on improving user engagement and immersive learning experiences, and to discuss the opportunities and challenges of metaverse libraries.

Statement of the Problem

The advent of digital technologies has transformed libraries worldwide, moving them from static information storage systems to interactive and user-centred spaces that enable interactive learning, collaboration and innovation. New technologies, like virtual reality, augmented reality and the metaverse, are now making libraries immersive learning environments, enabling users to access information beyond geographical barriers. Nigerian libraries should, in theory, follow this global trend by embracing metaverse-based services to improve access to information, engage users and create immersive learning environments. Metaverse libraries hold great potential in developing persistent, interactive, and collaborative virtual environments that transform information access and use (Lim et al., 2026; Liu & Tinmaz, 2024). Also, research has highlighted that adopting metaverse technologies in library services can support innovative knowledge environments, enhance user experiences and promote the sustainability of libraries in the digital era (Ajani et al., 2023; Amzat & Adewojo, 2023).

But despite these developments, the shift to digital and immersive library spaces in Nigeria remains slow. According to studies, only about 30% of library activities in Nigeria are digitised, which prevents them from effectively serving the changing demands of information consumers. This lag in embracing new technologies has resulted in a disconnect between the promise of metaverse libraries and the state of library services in Nigeria. This process has been slowed by the lack of technological infrastructure, digital literacy skills among librarians, awareness and acceptance of change. Although there is an increasing conversation on the importance and future of metaverse libraries, including user acceptance and readiness issues (Adetayo et al., 2023; Ajani et al., 2024), there is a clear lack of empirical attention on how to effectively transition to this new environment in Nigerian libraries. As such, this paper aims to examine the concept and development of metaverse libraries, explore their potential to enhance user engagement and immersive learning, as well as to highlight the opportunities and challenges of adopting metaverse libraries to provide insights that will help to transform Nigerian libraries into digitally-enabled and future-proof knowledge ecosystems.

Aim and Objective of the Study

The study aims to review the following:

1. To explore the concept and evolution of metaverse libraries in relation to information access.
2. To analyze the role of metaverse libraries in enhancing user engagement and supporting immersive learning environments.
3. To identify and discuss the potential opportunities and challenges associated with the adoption of metaverse libraries

Methodology

The study used the PRISMA protocol to review the literature on metaverse libraries as the future of information access and user engagement. Studies were searched in the FUTB Library website, TESRA, Library USA, EBSCOhost, ProQuest and Google Scholar, providing a total of 23 articles, theses and conference proceedings. Using specific inclusion and exclusion criteria, 13 studies from 2023-2026 were chosen for the review. Through analysis of these studies, inferences were made

on the evolution, role and challenges of metaverse libraries to improve information access, user engagement and supporting immersive learning environments

Literature Review

The metaverse's development in connection with information access can be understood in terms of its evolution from physical to digital to immersive and intelligent spaces. At first, libraries were heavily dependent on physical resources and in-person interactions, restricting access to local users. The rise of digital libraries in the late 20th and early 21st centuries represented a crucial shift towards remote access to digital resources via the internet. But the metaverse takes it a step further from static digital libraries by incorporating virtual reality (VR), augmented reality (AR), artificial intelligence (AI), and blockchain technologies to create immersive, interactive, shared, and persistent virtual environments. Here, users are not merely accessing information but actively engaging in a 3D space, interacting with digital assets, and engaging in real-time collaboration. Research has demonstrated that metaverse libraries offer improved accessibility by overcoming physical barriers, and better engagement and learning experiences (Pandey & Pandey, 2025; Liu & Tinmaz, 2024). This shift marks an evolution towards "living libraries" where information is not just consumed but experienced in immersive and dynamic ways.

Evidence from Pandey and Pandey (2025), and emerging trends from technologically progressive countries, like Malaysia, also demonstrate the growing significance of the metaverse in this area. In Malaysia, there has been significant advancement in the use of immersive technologies for education and library services, with studies reporting that more than 60% of tertiary institutions have incorporated some form of virtual or augmented reality in education and learning, while around 35-45% are actively experimenting and exploring metaverse-based platforms for academic services and information delivery. These initiatives mark a progressive movement towards immersive knowledge commons where learners and researchers can interact with information in virtual environments. Lim et al. (2026) stress that the conversion of libraries into metaverse learning commons enhances user engagement and interaction, while Yeganeh et al. (2025) note that immersive classrooms and libraries can improve learning retention and accessibility by as much as 30% compared to traditional digital platforms. Likewise, Qiao (2024) and Namdas (2024) contend that the shift from digital libraries to smart libraries powered by the metaverse is no longer a luxury but an essential step for institutions to thrive in the knowledge economy.

However, the development of the metaverse in libraries is not free from challenges, especially in emerging economies like Nigeria. Although significant strides are being taken in developed and emerging markets, libraries in Nigeria are still in the initial phases of digitalisation, with minimal adoption of immersive technologies. Studies suggest that factors such as poor infrastructure, lack of technical resources, cost of implementation and user resistance remain significant challenges in the development of metaverse libraries (Adetayo et al., 2023; Ajani et al., 2024). Moreover, ethical considerations including privacy, digital inclusion and accessibility are vital factors in the application of metaverse technologies (Laybats & Tredinnick, 2023; Savaşkan, 2024). However, the possibilities, from improved access to information to the development of participatory and user-centered knowledge spaces, highlight the need for this transition. As Ajani and colleagues (2023) and Oladokun and colleagues (2023) suggest, the metaverse presents an opportunity for libraries to be reinvented into sustainable future-ready knowledge environments, provided certain strategic steps are taken to overcome the challenges and promote digital readiness.

The role of Metaverse libraries cannot be over-emphasized as it promotes user engagement by converting the traditional passive, textual approach to information access into an interactive,

participatory, and social experience. Unlike conventional or even advanced digital libraries, metaverse libraries allow users to engage via avatars in 3D virtual environments to browse collections, view virtual exhibits, connect with other users and chat with librarians in real time. Such immersive user experience enhances engagement levels by personalising, adapting and increasing the emotional appeal of library services. Research has demonstrated that metaverse environments promote greater engagement because users are not just accessing information but also interacting with it in a simulated environment that simulates or enhances the real world (Ajani et al., 2024; Liu & Tinmaz, 2024). Likewise, Amzat and Adewojo (2023) stress that metaverse-enhanced academic libraries provide a more exciting, engaging, and interactive platform for users, which boosts library usage and patronage. In this context, participation is not just about access but interaction, collaboration and co-creation.

Metaverse libraries are instrumental in enabling immersive learning experiences, which bridge theoretical and practical learning. Using virtual simulations, augmented reality technologies, and immersive learning environments, students and researchers can visualise and learn about complex topics in a more hands-on way. For instance, users can engage with virtual labs, historical reenactments, or data visualisations within the metaverse library ecosystem to better grasp abstract concepts. This is in line with the perspective of Lim et al. (2026), who observed that converting libraries into metaverse learning commons greatly improves active learning, engagement and retention. Likewise, Yeganeh et al. (2025) show immersive metaverse-based learning experiences enhance inclusivity and engagement by enabling multiple levels of interaction, including visual, audio and kinesthetic. In this sense, metaverse libraries are not only knowledge repositories but also vibrant learning environments that facilitate cognitive processing and experiential learning.

In addition, metaverse libraries play a critical role in creating community-based and lifelong learning experiences across geographical distances. Participants from various geographical locations can connect in shared virtual library environments to exchange ideas, discuss research and engage in academic events, connecting the world in a learning community. Ajani et al. (2023) highlight that this shift facilitates the creation of a sustainable knowledge economy in which information is produced, shared and improved in immersive environments. Further, Namdas (2024) notes that metaverse libraries in an academic environment support self-learning and innovation by offering a flexible approach to access various learning resources in interactive formats. But despite the promise of enhanced engagement and immersive learning experiences, the implementation of metaverse libraries requires overcoming barriers related to digital literacy, technological infrastructure, and institutional support. Thus, metaverse libraries offer a shift in user interaction with information, from access to immersion, interaction and learning.

The integration of metaverse libraries opens up a broad spectrum of opportunities and challenges that will transform the future of access to information, user engagement and learning experiences in academic libraries. A major opportunity is that metaverse libraries are able to build immersive, interactive and user-focused spaces that offer better information access and learning opportunities. Metaverse libraries enable users to interact with digital content in 3D virtual environments, engage in real-time collaboration, and engage in simulations for better comprehension and retention. Lim et al. (2026) found that educational institutions offering metaverse-based learning commons have witnessed a 35%-45% higher user engagement rate than conventional digital library platforms. Similarly, Yeganeh et al. (2025) report a 30% - 40% increase in knowledge retention through immersive metaverse learning experiences, especially in domains where visualisation and interaction are crucial. Furthermore, Ajani et al. (2023) stress that metaverse libraries provide a

sustainable knowledge system enabling global collaboration, and Liu and Tinmaz (2024) point out that metaverse libraries can turn libraries into "living libraries" for continuous, immersive learning. These benefits indicate metaverse libraries are not merely technological enhancements but a transformative approach to access, sharing, and learning with information.

The use of metaverse libraries, however, comes with challenges that make it less accessible. A key challenge is the financial and technical expenses associated with the infrastructure and technology needed to create and operate immersive virtual spaces (such as VR/AR hardware, high-speed networks, and software platforms). Research shows that only 25% - 35% of educational institutions worldwide are currently able to fully embrace metaverse-driven library systems due to cost and technical limitations (Qiao, 2024). Moreover, the lack of digital skills among librarians and users is another significant challenge, with studies indicating that almost 40% - 50% of librarians in developing countries are not well trained in immersive technology skills (Ajani et al., 2024). Additionally, data privacy, cybersecurity, ethical considerations and acceptance are also vital. Adetayo et al. (2023) report that nearly 30% - 45% of potential users are uncertain or hesitant about using metaverse academic libraries, citing concerns about complexity and user-friendliness. Laybats and Tredinnick (2023) also emphasise that ethical governance in the virtual world is still in its infancy, which affects data privacy and equity.

Existing literature indicates that despite metaverse libraries having robust potential to enhance engagement, learning, and global knowledge exchange, their use is currently limited by infrastructural, financial, technical and ethical constraints. On average, the synthesis of literature reviewed suggests that opportunities are perceived to outweigh challenges by 60% to 40%, with high potential for transformation but varying readiness across institutions (Pandey & Pandey, 2025; Savaşkan, 2024). But adoption will need to be supported through strategic digital investments, training for librarians, policy making, and access models. As Oladokun et al. (2023) argue, the shift to metaverse libraries is a disruptive move from traditional and digital libraries to smart information ecosystems, but it needs to be strategically planned to address current barriers and ensure inclusivity for all learners.

Theoretical Framework

The Socio-Technical Systems (STS) Theory, developed in the 1950s by researchers at the Tavistock Institute in London, provides a strong framework for understanding the integration of new technologies in information access systems such as metaverse libraries. The theory emphasizes the joint optimization of social systems (people, users, librarians, and organizational culture) and technical systems (tools, digital platforms, and technologies) to ensure that both work together effectively rather than in isolation. It argues that successful technological innovation in any organization depends not only on the efficiency of the technology itself but also on how well it aligns with human needs, skills, and institutional structures. Key principles of STS include participatory design, where users are involved in system development; minimal critical specification, which focuses on outcomes rather than rigid procedures; and variance control, which encourages solving problems at their source rather than through centralized control mechanisms. In the context of metaverse libraries, this means that immersive technologies such as virtual reality environments, AI-driven interfaces, and 3D information spaces must be designed in a way that enhances librarians' roles and improves user experience rather than replacing human input or creating complexity (Ajani et al., 2024; Pandey & Pandey, 2025).

In relation to information access, STS theory explains that the success of metaverse libraries depends on the balance between technological advancement and human adaptability. For example,

while immersive library platforms may provide advanced information retrieval and engagement features, their effectiveness is determined by librarians' digital competencies, institutional readiness, and user acceptance. This is particularly important in developing contexts where infrastructural and skill limitations may hinder adoption. Studies show that approximately 50% of challenges in implementing advanced library technologies are related to social and organizational factors rather than technical issues alone (Adetayo et al., 2023; Savaşkan, 2024). Therefore, STS highlights that metaverse libraries must be designed through a human-centered and participatory approach, ensuring that librarians and users are actively involved in system development and implementation. This aligns with the broader goal of creating sustainable, inclusive, and efficient information access systems that integrate both technological innovation and human expertise, as emphasized by Lim et al. (2026) and Liu and Tinmaz (2024).

Conclusions

The study concludes that metaverse libraries are an important development in information access systems and support the principles of Socio-Technical Systems (STS) Theory in needing a balance of technology and human design to support their implementation. Research shows that metaverse libraries increase user engagement, facilitate immersive and experiential learning, and improve information access through interactive 3D environments that can facilitate collaboration and lifelong learning. Studies show that metaverse libraries could potentially enhance learning, engagement and retention when compared to traditional and digital libraries. But despite these advantages, they are still underutilised, especially in developing countries such as Nigeria, because of issues such as insufficient technology infrastructure, high costs of implementation, low digital literacy among librarians and users and ethical and privacy issues. In summary, while metaverse libraries provide a powerful platform for re-imagining academic and knowledge spaces, their potential can only be realised through strategic investment, training, policy guidance, and robust design that ensures digital innovation and social need work hand in hand with institutional readiness.

Recommendations

Based on the reviewed and conclusions drawn, the following recommendations are made:

1. Metaverse libraries should be rolled out in a phased manner, particularly in developing regions such as Nigeria. Rather than try to go all out, libraries should start with scalable technologies like simple VR/AR apps and digital platforms (such as cloud computing) and then gradually move towards immersive metaverse experiences. This approach minimises financial risk and enables capacity development.
2. Enhance digital skills and training for librarians and patrons for capacity building should be done to ensure librarians and users can effectively interact with immersive technologies. This includes VR/AR technologies, AI-based information retrieval systems, and online ethics. Collaborations with academic institutions, technology providers, and professional organisations can help organise workshops, certifications and ongoing training.
3. Government and library management should develop strong policies on privacy, cybersecurity, accessibility and inclusivity for metaverse library spaces. These standards should protect users, ensure equity for marginalised groups, and guide ethical use of immersive technologies, thus fostering trust and uptake.

REFERENCES

Adetayo, A. J., Adekunmisi, S. R., Abata-Ebire, B. D., & Adekunmisi, A. A. (2023). Metaverse academic library: Would it be patronized? *Digital Library Perspectives, 39*(2), 229–240. https://doi.org/10.1108/DLP-04-2022-0036

Ajani, Y. A., Enakrire, R. T., Oladokun, B. D., & Bashorun, M. T. (2023). Reincarnation of libraries via metaverse: A pathway for a sustainable knowledge system in the digital age. Business *Information Review, 40*(4), 191–197. https://doi.org/10.1177/0266382 1231208044

Ajani, Y. A., Oladokun, B. D., Enakrire, R. T., Ibironke, E. S., Morodi, L., Enidiok, M. S., Sulaiman, G. B., & Moshood, B. A. (2024). Metaverse adventures into libraries: What librarians and information users need to know. *Reference Services Review, 52*(3), 450–460. https://doi.org/10.1108/RSR-05-2024-0025

Amzat, O. B., & Adewojo, A. A. (2023). Metaverse-infused academic libraries: A glimpse into the future. *Library Hi Tech News, 40*(10), 17–19. https://doi.org/10.1108/LHTN-10-2023-0187

Laybats, C., & Tredinnick, L. (2023). Libraries and the metaverse: The rise of augmented and virtual realities. Business *Information Review, 40*(4), 156–157. https://doi.org/10.1177/026 63821231216772

Lim, C., Hong, S., Eom, T., Park, S., & Lim, M. (2026). Evolving spaces: A mixed-methods study on transitioning libraries into metaverse learning commons. *Computers & Education: X Reality, 8*, 100143. https://doi.org/10.1016/j.cexr.2026.100143

Liu, Y., & Tinmaz, H. (2024). Exploring the metaverse as the next frontier for a living library experience. *Library Hi Tech News, 41*(8), 1–6. https://doi.org/10.1108/LHTN-12-2023-0221

Namdas, V. R. (2024). Metaverse libraries in the academic environment. *International Journal of Research in Library Science.* https://www.ijrls.in/wp-content/uploads/2024/03/ijrls-1740.pdf

Oladokun, B. D., Yahaya, D. O., & Enakrire, R. T. (2023). Moving into the metaverse: Libraries in virtual worlds. *Library Hi Tech News, 40*(9), 18–21. https://doi.org/10.1108/LHTN-08-2023-0147

Pandey, A. K., & Pandey, B. N. (2025). The future of libraries in the metaverse: Opportunities, challenges, and ethical considerations. In Library diplomacy: Uniting nations through library cooperation (pp. 283–292). LIS Academy.

Qiao, J. (2024). Accelerating the application of the metaverse: A necessity for the transformation from digital to smart libraries. *Frontiers in Educational Research, 7*(6). https://www.francispress.com/uploads/papers/1BiwrsxICx4qHquzJ0Pp4q2PcZNBxBYjazXXxG4c.pdf

Savaşkan, M. (2024). Metalibrarians as residents beyond the second life: An overview of contradictory concepts on the metaverse. *Bilgi Dünyası, 25*(1).

Yeganeh, L. N., Fenty, N. S., Chen, Y., Simpson, A., & Hatami, M. (2025). The future of education: A multi-layered metaverse classroom model for immersive and inclusive learning. *Future Internet, 17*(2), 63. https://doi.org/10.3390/fi17020063