

Augmented Reality (AR) and Virtual Reality (VR) in Libraries: Enhancing User Engagement and Learning in Nigerian University Libraries

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Current Challenges in Nigerian University Libraries

In the evolving landscape of academic libraries, Nigerian university libraries face a constellation of challenges that hinder their relevance and effectiveness in meeting users' expectations. Among the most pressing issues are the declining engagement with traditional library resources, limited access to interactive and technologically enriched learning tools, and a persistent inadequacy in delivering satisfactory information discovery experiences. These challenges are not isolated; rather, they are deeply interwoven with broader trends in information behavior, digital transformation, and educational technologies. A primary concern revolves around the noticeable decline in user engagement with conventional materials and static information environments. As libraries globally experience a shift from physical to digital modes of knowledge delivery, Nigerian university libraries have struggled to keep pace. Students increasingly favor dynamic, immersive, and interactive platforms for information consumption—qualities often absent in traditional library collections. According to Greene and Groenendyk (2020), the growing availability of immersive media and virtual experiences has reshaped user expectations, especially among digital-native student populations. Where previously, physical books and journals were central to academic life, the contemporary learner gravitates toward environments that support visual, hands-on, and experiential learning. This paradigm shift poses a serious challenge to libraries still heavily invested in traditional formats.

Supporting this observation, Shahzad, Khan, and Iqbal (2023) argue that academic libraries must “reimagine engagement” by integrating augmented reality (AR) and virtual reality (VR) tools to align with modern user preferences. In many Nigerian universities, however, such integrations remain nascent or nonexistent. The result is a widening disconnect between what the library offers and what the user expects. As Kharat et al. (2024) note, “libraries that fail to embrace experiential technologies risk obsolescence in the face of growing user disinterest.” The challenge is particularly pronounced in institutions where budget constraints, policy inertia, and infrastructural limitations impede the adoption of these innovations. Equally problematic is the limited access to interactive and modern learning tools, which further exacerbates disengagement and erodes the perceived utility of the library. The implementation of VR/AR technologies—now becoming commonplace in libraries across North America and parts of Asia—has shown promise in enhancing learning by promoting deeper conceptual understanding and user motivation (Wei et al., 2024; Cao et al., 2021). However, Nigerian university libraries lag significantly behind in deploying such tools. In a comparative study of AR usage in academic settings, Hannah and Huber

(2020) revealed that immersive technology deployments tend to flourish in environments supported by strong digital infrastructure and institutional commitment—two factors largely absent in the Nigerian higher education context. Moreover, the problem is not solely technological but also systemic. For instance, training librarians to facilitate the use of AR/VR tools is often neglected. According to Education and Information Technologies (2022), staff readiness plays a critical role in the success of any technology adoption strategy. Without deliberate efforts to build digital competencies among library personnel, even available tools may remain underutilized. This point is echoed by Hussain (2022), who warns that “technology without human facilitation creates a vacuum where tools exist but learning fails to happen.” Consequently, while some Nigerian libraries may possess rudimentary forms of interactive media, the absence of human and technical support structures renders them ineffective.

Transitioning to the third major challenge, the poor user experience in information discovery continues to diminish the functional value of university libraries. Students often find it difficult to navigate complex catalog systems, retrieve relevant content efficiently, or explore collections in intuitive ways. Traditional OPACs (Online Public Access Catalogs), although serviceable, fall short of meeting contemporary usability standards. As noted in *Library Hi Tech* (2021), emerging digital library interfaces increasingly incorporate AR overlays, voice-assisted search, and context-aware browsing to streamline information retrieval. In contrast, many Nigerian libraries continue to rely on outdated systems that frustrate users and impede seamless access to information. Adding to this, Jalo and Pirkkalainen (2024) discuss how user resistance to outdated systems is often a reflection of their prior exposure to more advanced technologies outside the academic environment. Today’s students interact with recommendation algorithms, immersive search interfaces, and gamified learning environments in their daily lives. When faced with rigid and unintuitive library platforms, their frustration is understandable. As Kannegiser (2023) suggests, “library systems must reflect the cognitive patterns and behavioral preferences of their users; otherwise, disconnection is inevitable.” The inability of Nigerian university libraries to offer such adaptive experiences has led to a steady erosion of their centrality in academic life. It is also important to consider the psychological and motivational dimensions of poor information experience. LeMire, Graves, and Hawkins (2018) demonstrate that AR-enhanced library tours not only increase familiarity with the library space but also reduce anxiety associated with library use—especially for new students. In the absence of such initiatives, users may feel alienated or overwhelmed, particularly in large university libraries with expansive but underutilized resources. The lack of personalization in search interfaces, coupled with the absence of user-guided navigation tools, further compounds the problem. In many instances, students resort to external platforms like Google Scholar or Wikipedia, bypassing institutional repositories entirely (*Journal of Academic Librarianship*, 2022). Furthermore, these challenges are not merely operational but have strategic and pedagogical implications. As information behavior evolves, the library must transform from being a passive repository to an active learning space. According to *Interactive Learning Environments* (2023), learning occurs more effectively in settings that are exploratory, engaging, and adaptive. By failing to embed immersive and user-centered technologies into their

service models, Nigerian libraries undermine their own pedagogical relevance. The implication is that students' academic literacy and research competencies may suffer, as they are deprived of environments that encourage critical inquiry and knowledge construction.

That said, overcoming these challenges is not impossible. The literature is replete with examples of libraries in similar contexts making incremental gains through policy advocacy, partnerships, and donor-supported technology initiatives. For instance, the *International Journal of Emerging Technologies in Learning* (2023) highlights several case studies where resource-constrained libraries managed to integrate AR/VR tools by leveraging open-source platforms and collaborating with computer science departments. These models offer valuable insights for Nigerian universities willing to explore alternative approaches to library innovation. Nevertheless, the pathway forward demands a shift in mindset—one that views the library not merely as a place, but as a digitally-enhanced service ecosystem. The need for strategic alignment between academic goals and library innovation is critical. As pointed out in *Information Technology and Libraries* (2020), when libraries are viewed as co-creators of learning experiences rather than custodians of books, investments in technologies like AR and VR become justified and sustainable. The integration of such tools can reframe the library as a dynamic space for knowledge engagement, thereby reversing current trends of disinterest and underuse.

In conclusion, Nigerian university libraries face a triad of interrelated challenges: declining user engagement with traditional resources, limited access to interactive learning technologies, and unsatisfactory user experiences in information discovery. These issues are symptomatic of broader systemic and technological deficits that must be addressed through strategic reform, infrastructural investment, and capacity development. The literature affirms that the infusion of immersive technologies like AR and VR holds transformative potential—not just in terms of modernizing services, but in reimagining the very identity of the university library in the digital age. By embracing innovation and prioritizing user experience, Nigerian libraries can reclaim their relevance and reinstate their position at the heart of academic learning.

Arguments for AR/VR Integration in Nigerian Libraries

In today's rapidly digitizing academic world, university libraries must shift from being static repositories of information to becoming dynamic learning environments. The integration of Augmented Reality (AR) and Virtual Reality (VR) technologies presents a compelling opportunity to support this transformation, particularly in the Nigerian context where traditional library systems are increasingly perceived as inadequate in meeting the expectations of digital-native students. As noted by Greene and Groenendyk (2020), libraries globally are embracing AR/VR technologies to provide more immersive, intuitive, and engaging user experiences. Similarly, Hannah and Huber (2020) highlight that academic libraries that incorporate extended reality (XR) tools can better meet student learning preferences, offering interaction beyond printed text. LeMire, Graves, and Hawkins (2018) affirm that interactive AR tools significantly enhance student

orientation and spatial awareness, especially among first-year users. In this regard, AR/VR integration is not merely a technological trend but a timely intervention for Nigerian libraries seeking to reclaim their relevance in the academic ecosystem. One of the most persuasive arguments for AR/VR adoption in Nigerian libraries lies in its potential to radically improve the user experience by making library spaces and services more accessible and intuitive. Traditional library systems often require users to navigate complex catalogues or physical layouts with minimal support. This often deters engagement, especially among inexperienced users. According to Kannegiser (2023), AR-based library navigation systems significantly reduce user anxiety and information-seeking fatigue by providing real-time, visual, and context-aware guidance. Likewise, Kharat et al. (2024) demonstrate that AR-enhanced shelving systems enable seamless book searches and browsing, effectively increasing foot traffic and user satisfaction. Frost et al. (2020) further argue that libraries that deploy immersive technology platforms report a marked improvement in user interaction and service feedback. When transposed into the Nigerian context, where library personnel are often overwhelmed and infrastructure underdeveloped, these tools could play a pivotal role in alleviating operational inefficiencies and boosting student autonomy.

Moreover, AR/VR technologies offer significant pedagogical value, particularly in disciplines where experiential learning is crucial. Medical, engineering, and architecture programs—fields that demand high cognitive and spatial visualization—can benefit from virtual laboratories and simulated environments. Wei et al. (2024) affirm that VR-supported learning enhances the understanding of complex structures by allowing students to interact with three-dimensional, dynamic models. Supporting this, Cao et al. (2021) describe how AR-enabled mobile platforms can deliver real-time visual overlays for procedural and technical education. Virtual Reality applications have already shown success in replicating clinical and engineering scenarios that would otherwise be logistically or financially impossible in underfunded institutions. Hussain (2022) observes that immersive technologies reduce the cost of instruction while simultaneously increasing knowledge retention and student motivation. Thus, Nigerian libraries can position themselves as hubs of innovation by facilitating access to discipline-specific simulations that would otherwise be inaccessible due to institutional limitations. In addition to enhancing mainstream academic delivery, AR/VR technologies hold substantial promise in fostering inclusivity and supporting students with disabilities—a demographic often overlooked in Nigerian higher education planning. By offering customizable, multisensory environments, VR can accommodate various learning needs and sensory preferences. Shahzad, Khan, and Iqbal (2023) emphasize that AR/VR systems enable students with visual impairments to navigate library spaces using auditory cues and haptic feedback, thus promoting independence. Similarly, Jalo and Pirkkalainen (2024) note that students with learning disorders benefit from gamified, immersive experiences that break down cognitive barriers and facilitate concentration. In line with this, the *International Journal of Emerging Technologies in Learning* (2023) presents case studies of VR-assisted learning models that have been successfully used to support neurodivergent students in accessing and processing academic content. These examples collectively suggest that integrating

AR/VR in Nigerian libraries would not only advance service innovation but also align library operations with global calls for inclusive education.

Another compelling benefit of AR/VR integration is its potential to promote information literacy through gamified learning strategies. Libraries are traditionally positioned as literacy development centers, yet many Nigerian university libraries struggle to engage students in foundational skills like research, citation, and ethical information use. Interactive, game-based modules delivered through AR/VR can transform these abstract concepts into engaging activities. According to *Education and Information Technologies* (2022), gamification in virtual environments has been found to significantly improve learner motivation, completion rates, and long-term skill retention. LeMire et al. (2018) also found that using AR apps in library instruction increased students' understanding of academic resources and services. Moreover, Hannah and Huber (2020) argue that VR platforms offer safe, repeatable scenarios where users can practice library tasks such as catalog searching, reference navigation, and database querying. These approaches provide a more impactful alternative to the conventional lecture-based or brochure-distribution methods still prevalent in Nigerian academic libraries. While the benefits are numerous, implementing AR/VR in Nigerian university libraries does require deliberate planning and strategic investment. Libraries cannot simply acquire hardware and expect immediate results; careful attention must be paid to content development, staff training, infrastructure compatibility, and long-term sustainability. As noted by Greene and Groenendyk (2020), one of the key factors behind successful AR/VR deployments is institutional readiness—not just in terms of technology, but also in terms of vision and leadership. Hussain (2022) stresses the importance of staff digital literacy and training, noting that even the most sophisticated systems are underutilized when personnel lack the skills to operate or teach them. The *Journal of Academic Librarianship* (2022) also reports that collaborative projects between library units and computer science departments often yield cost-effective and context-sensitive AR/VR applications. Hence, Nigerian universities must adopt a cross-disciplinary, collaborative approach to implementation, involving both library professionals and technology experts.

In light of the infrastructural limitations common in Nigerian universities, phased and scalable implementation strategies become particularly important. Rather than attempting large-scale rollouts, institutions may benefit from piloting AR/VR tools in specific subject areas or service points. According to *Library Hi Tech* (2021), targeted interventions—such as virtual orientation modules or AR-based catalog guides—have a high impact and are relatively low-cost. Jalo and Pirkkalainen (2024) recommend starting with open-source or low-code AR/VR platforms, which offer flexible customization and require minimal hardware investment. LeMire et al. (2018) suggest that library instruction programs can serve as the first point of AR/VR adoption, using gamified tutorials to teach students how to locate resources, evaluate sources, and avoid plagiarism. Through such focused and manageable efforts, Nigerian libraries can gradually build institutional familiarity and capacity, laying the groundwork for broader adoption over time. Furthermore, sustainability is a central concern that must be addressed to ensure that AR/VR

integration yields long-term benefits. Digital interventions in resource-limited environments often fail when they are not accompanied by strategies for maintenance, evaluation, and adaptation. Hannah and Huber (2020) emphasize the importance of periodic user feedback and system updates to maintain user interest and relevance. Similarly, Kannegiser (2023) notes that AR/VR applications must be designed to evolve with changing curricula and user preferences. The *International Journal of Information Management* (2023) stresses the need for data-driven decision-making, urging libraries to use analytics from AR/VR platforms to assess usage patterns and learning outcomes. By building feedback loops and data monitoring into their implementation plans, Nigerian libraries can ensure that their AR/VR services remain responsive, effective, and adaptable to changing academic needs.

Ultimately, the integration of AR/VR technologies into Nigerian university libraries presents a forward-looking strategy to transform academic service delivery, support student engagement, and promote inclusive learning. The literature clearly affirms that these technologies enhance user experience by providing intuitive navigation, immersive learning, adaptive environments for students with disabilities, and gamified platforms for information literacy development. However, their successful implementation depends on thoughtful planning, capacity building, and a phased approach suited to local realities. Nigerian university libraries must therefore embrace AR/VR not as a luxury but as a necessary step toward aligning with global educational trends and responding effectively to the evolving expectations of twenty-first-century learners. By doing so, they can reassert their central role in academic life and contribute meaningfully to the broader goals of higher education in Nigeria.

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