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Original Research

An Exploratory SWOT Analysis of Virtual Reality in Iranian Academic Libraries: Insights from Expert Focus Groups and a Literature Review

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Highlights

- The results serve as a valuable asset for the strategic planning of VR in academic libraries.
- The results pertain to the redefinition of the strategic role of librarians within academic libraries
- The provision of robust digital assets to academic libraries constitutes one of their significant strengths.
- Identifying potential threats and weaknesses enables academic library managers to implement VR from a more realistic perspective.

Abstract

This research explores the potential for VR adoption in Iranian academic libraries through an exploratory SWOT analysis using a descriptive-analytical method. The study includes information science and knowledge specialists, librarians, engineers, and computer science specialists selected using the snowball method. Data collection methods include interviews and literature reviews. The findings suggest that virtual reality technology can support the curriculum's cognitive and behavioral goals, improve learner-learner-content interactions, enhance information literacy, and

facilitate virtual visits to familiarize users with library services and resources. This study provides a forward-looking framework for how VR might reshape library services—if implemented with careful planning. The assessment of virtual reality technology's activities in Iranian academic libraries will help managers and investors make informed decisions. While virtual reality technology offers numerous opportunities, proper planning and management are needed to utilize it and address potential challenges effectively. Ultimately, this research can contribute to the innovation and development of academic libraries as multi-purpose and innovative institutions.

Keywords: Academic Library, Virtual Library, Virtual Reality, Simulated Reality, Iran.

Introduction

With advances in technology and the widespread adoption of the Internet, the role of academic libraries as the primary source of information has changed. Therefore, it is necessary for libraries to upgrade their services to keep pace with new technologies and participate in this virtual revolution (Iakovides, Lazarou, Kyriakou & Aristidou, 2022). Academic libraries operate with the aim of serving students, staff, faculty, alumni, and independent researchers and face various challenges, such as designing and implementing university-wide information literacy programs, providing classroom training to strengthen such skills, and collaborating with faculty and educational developers.

Students and faculty members, the main users of academic libraries, have high expectations of the academic environment and of professional librarians. Students live in a digital environment; they are actively present in digital classrooms. They undoubtedly expect to be educated on equal terms, without restrictions, with the dismantling of geographical borders, in accordance with international standards, and to collaborate with other professors and students from around the world. In this regard, connecting learning communities should become a strategic objective for academic librarians (Hill, Vans &Jones, 2017).

Librarians have been at the forefront of using the virtual world and providing virtual services, such as e-learning. Librarians at the University of Hawaii, Sheffield University, Stanford University, and San José State University have created and delivered e-learning programs for students, often teaching students how to develop and use virtual programs (Hill, 2012).

The main objective of Extended Reality (XR) technologies, such as Virtual Reality (VR), is to create a shared virtual space in libraries so that all virtual worlds are connected via the Internet, and users as Digital Avatars can communicate and collaborate as in the real world (Cheng, Wu, Chen & Han, 2022). In simple terms, VR is a simulated experience that can be similar to or completely different from the real world. This experience creates the perception of physical presence in a non-physical world by immersing the user in VR, using images, sounds, or other stimuli to create an engaging, complete environment (Williams & Nwagwu, 2025). If new VR-based e-learning models are developed, physical presence in classes, workshops, and seminars will no longer be a special educational experience. Avatar body language in remote settings makes virtual participation as effective as in-person classes and conferences (Mystakidis, 2022). Additionally, VR can facilitate active blended learning, fostering deeper, more sustainable knowledge. More importantly, there is the issue of equity in

education, and this environment can enable and enhance global participation on equal terms without geographical limitations (Mystakidis, 2022). It can be said that virtual classes and webinars have solved this problem to some extent; however, a significant problem is that it does not give users a sense of shared presence (Hill, 2022).

Globalization and the increasing acceptance of new technologies in academic libraries, on the one hand, and the synchronization of academic libraries with emerging technologies (e.g., VR), on the other hand, have created the necessary platforms for delivering more up-to-date and efficient services to users. Initial studies indicate that many academic libraries in developed countries have achieved significant benefits and opportunities by utilizing VR capabilities; however, in developing countries, the application of such new technologies in libraries remains in its initial, experimental stages. Iranian academic libraries are no exception to this rule. Recent peer-reviewed studies confirm that academic libraries in developed countries (e.g., the U.S., U.K., and Hong Kong) have successfully implemented VR services to enhance learning and user engagement (Greene & Groenendyk, 2021; Taha, Kaba, & Al-Qeed, 2024; Frost, Goates, Cheng & Johnston, 2020). In contrast, VR technology has not yet been implemented operationally or extensively in Iranian academic libraries, and no empirical studies have documented its strengths, weaknesses, opportunities, or threats in this specific context.

In other words, VR technology has not yet been implemented operationally, practically, and extensively in Iranian academic libraries, and no reliable information resulting from research has been observed regarding the implementation and application of VR technology in Iranian academic libraries and the strengths, weaknesses, opportunities, and threats of implementing VR in Iranian academic libraries. To address the aforementioned problem, a SWOT analysis, which encompasses strengths, weaknesses, opportunities, and threats, was employed. By conducting a SWOT analysis, a successful strategy for adopting new technology in education and research is to capitalize on technological opportunities, leverage its strengths, and address threats by mitigating its weaknesses. The SWOT analysis provides a clear structure for collecting information from various sources. It provides a comprehensive view of internal (strengths and weaknesses) and external (threats and opportunities) factors that can affect the integration of new technologies in education (Farrokhnia, Banihashem, Noroozi & Wals, 2024). In addition, SWOT analysis helps managers and policymakers make informed decisions about implementing VR technology. Therefore, the primary objective of the current work is to examine the strengths, weaknesses, opportunities, and threats associated with the implementation and use of VR technology in Iranian academic libraries.

Meeting the changing and growing expectations of academic libraries has become a necessity. Any organization that fails to respond to and adapt to societal changes risks becoming obsolete; libraries are no exception. The dynamism and changing nature of academic libraries can be directly linked to the fifth law of the "Five Laws of Library Science" (Ranganathan, 1931).

"The Library is a Growing Organism," the fifth of Ranganathan's laws of library science, refers to this concept. This law emphasizes the need for libraries to evolve and adapt to users' changing needs and technological advancements. In addition, it encourages libraries to continuously innovate and integrate existing library services and technologies with new ones to survive.

A closed system always decreases in size and disappears after a specific period. As the

world moves towards simulated reality technologies, it is challenging for libraries not to keep up with the extraordinary changes happening around them (Rajesh, 2021). With the emergence of VR in libraries, particularly academic libraries, there is a need to research the key effective features of its technology to apply it in these settings, as well as to organize multidimensional information, which is a new form of information. Therefore, it is necessary first to conduct comprehensive theoretical research in this area and to measure the effectiveness, strengths, weaknesses, opportunities, and threats of this technology in academic libraries. Then, we will move on to the practical stage and conclude the implementation or replacement. This research aimed to examine the opportunities, threats, strengths, and weaknesses of VR in Iranian academic libraries. The findings of this study can help librarians become more familiar with this technology, its strengths, and opportunities, thereby empowering them to prepare effectively for related challenges and make informed decisions about adopting it. As a result, it leads to problem-solving and strong strategic planning. Given the necessity of comprehensive planning and policy formulation, the SWOT analysis method has been employed. This method effectively identifies and evaluates strengths, weaknesses, opportunities, and threats. Therefore, the results of this study serve as a strong tool for strategic planning and pave the way for the successful implementation of this technology in Iranian academic libraries.

The present research aimed to explore the potential strengths, weaknesses, opportunities, and threats associated with VR adoption in Iranian academic libraries. To achieve this primary objective, it is essential to answer the following questions.

Q1. What are the strengths of VR technology for Iranian academic libraries?

Q2. What are the weaknesses of VR technology for Iranian academic libraries?

Q3. What are the threats posed by the introduction of VR technology in Iranian academic libraries?

Q4. What are the opportunities presented by the introduction of VR technology for Iranian academic libraries?

Literature Review

The literature collected on VR technology and academic libraries can be categorized into the literature related to the professional development of librarians and users, factors influencing the adoption of VR technology, applications of VR technology, benefits and challenges of using VR technology, and finally, the impact of VR on students' motivation and learning performance.

Massis (2015) reviewed the benefits and applications of VR and AR technologies in the library setting in a scholarly article. In this article, they acknowledge that these technologies can enhance library services, help teach information literacy, and transform user interaction. Dyer, Swartzlander and Gugliucci (2018) investigated the application of VR technology in medical education to enhance empathy among medical students. The findings indicated that VR technology can simulate the experiences of patients with age-related diseases, thereby providing students with a deeper understanding of the challenges faced by older adults.

In line with previous research, Lischer-Katz, Cook and Boulden (2018) aimed to evaluate the impact of VR workstations on student learning in academic libraries; the findings demonstrated that VR can provide a better and more intuitive learning environment for students, enabling them to interact with 3D models of objects and spaces that are otherwise inaccessible. Colegrove's (2018) research also aimed to bridge the gap between practical applications and

academic research, providing a comprehensive review of how immersive technologies can be employed to improve library services, support educational goals, and foster innovative research practices.

Hahn (2018) presented the results of a case study on VR learning environments, focusing on the development and integration of multi-user reference support. They used the case study to understand the development of application software that includes text-browsing experiences in a VR headset. Moreover, Oyelude (2018) discussed the current trends and practical applications of these technologies, emphasizing their role in enhancing user experiences and delivering higher-quality services. They believe that VR and AR technologies have the potential to transform libraries and museums. These technologies can create immersive, interactive environments that significantly enhance user engagement and learning.

Hu, Zhang and Wang (2019) primarily discuss the introduction of VR technology into the development of digital libraries and propose a new service model for library visual information retrieval. This article challenges the traditional approach to building information platforms in libraries and examines the application of VR technology in visual information retrieval. Cook et al. (2019) believe that the use of VR in academic libraries is flourishing, but the lack of clear guidance for users on how to effectively introduce these technologies and make them sustainable across different types of institutions is a significant challenge. Such guidance should be specific enough to provide practical benefits and flexible enough to be helpful across a wide range of uses and practices.

Calvert (2019) has examined the use of VR technology as an innovative educational tool in library design. They aimed to address how VR can be used to create immersive and interactive learning environments. As a result, they designed and delivered an educational experience for students studying library design. Furthermore, Lund and Wang (2019) examined the impact of VR on student motivation and learning performance. They believe that VR, when used in education, may produce minor improvements in academic performance and significant improvements in student engagement. The findings of this study suggest that the use of VR in education is likely to increase students' motivation to learn and positively impact student performance. In another study, Napa, Moore and Bardyn (2019) evaluated the usability of two commercial VR applications, Bosc and Medical Holodeck, using a VR headset. This paper also examined physician attitudes toward VR technology and its viability for preoperative case planning, as well as the role of medical libraries in advancing case planning. Moreover, Hannah Huber and Matei (2019) discussed the potential educational applications of VR and AR in humanities/social sciences curricula and emphasized the critical need for academic libraries to collect and manage 3D objects.

Sample (2020) examined the use of AR and virtual reality in information literacy education to reduce library anxiety in international students. They believe that these technologies can provide a more engaging and interactive learning experience, thereby reducing anxiety and improving students' confidence in using library resources. Lee, King, Dahya and Lee (2020) examined librarians' perceptions of VR as well as the opportunities and challenges associated with implementing VR in public libraries. The findings indicated how VR can be used in public libraries as a learning tool.

Clark and Lischer-Katz (2020) reviewed emerging applications and benefits of VR technologies to support learning in academic libraries and outlined the challenges of making

VR accessible to students with disabilities. Suen, Chiu and Tang (2020) noted that although many academic libraries in the West have begun offering VR services to meet this trend, such deployments are not widespread in the East. Their article aimed to identify the reasons for this phenomenon. This study identified barriers to the deployment of VR services in academic libraries in Hong Kong. A lack of technical support, resources, and user needs is among the reasons for the phenomenon. In line with previous research, Frost et al. (2020) examined the application and expansion of VR services at the Brigham Young academic library through a survey. The results indicated that the interest in using VR services among Brigham Young academic library users is significant. The findings also demonstrated that the expansion of VR services is both justified and beneficial. However, implementing this technology requires careful planning. Greene and Groenendyk (2021) explored the adoption of emerging technologies in academic libraries and how these institutions organize their services around them. The study provides valuable insights into the current state of VR and AR services in academic libraries, underscoring the need for further research and development of the educational potential of these technologies.

In addition, Adetayo, Enamudu and Lawal (2021) addressed the significant challenges faced by people with disabilities in Nigerian libraries. They believe that these barriers lead to reduced access to services and lower patronage of libraries among people with disabilities. To address this issue, they propose the strategic implementation of VR technologies to enhance the accessibility and usability of library services for users with disabilities. Also, Ellern and Cruz (2021) examined libraries' support for VR and augmented reality technologies. The authors declared that implementing these technologies in libraries is fraught with complex challenges that challenge conventional problem-solving approaches. In line with previous research, Sams and Leither (2021) conducted a study with the primary objective of documenting the process and impact of transforming a traditional classroom into a VR classroom at the University of Utah Library. This study highlights the transformative potential of VR in creating inclusive learning environments that can significantly increase student engagement and learning outcomes. Kouame, Wood and Orlosky (2021) also examined the innovative use of VR technology to enhance health science education and promote well-being in an article titled "A Virtual Reality Library Space for Health-Centered Education and Well-Being." The main objective of their research was to explain how VR can be used to provide inclusive and experiential learning opportunities for health science students. Findings showed that VR not only facilitates a more engaging and effective learning environment but also contributes to student well-being by providing a new and stimulating educational experience.

Additionally, Lim (2021) proposed and developed a comprehensive VR-based library user training program to enhance user engagement and learning outcomes. The findings emphasize VR's potential to create immersive, interactive learning environments, thereby significantly enhancing the learning experience for library users. This study highlighted the importance of adopting advanced technologies to foster innovation and improve learning outcomes in library environments. In line with previous research, Lee, Hollister, Lim, Kim and Ryu (2022) provided foundational guidance and best practices for designing and developing training programs for librarians. Findings indicated that VR can create inclusive and interactive learning environments that foster greater empathy and cultural competence. Also, Dumas, Williams, Flanagan and Porwol (2022) highlighted the potential of VR for teaching library and information science students. This research could provide opportunities for faculty to approach

library and information science education in the department and support students' training in critical yet challenging soft skills, such as empathy and communication.

Noh and Shin (2022) reviewed the general concepts, technologies, trends, and examples of VR and AR. They believe that it is first necessary to build an innovative experiential play space that can meet cultural demands across time and space by providing immersive content using VR and AR. To activate and utilize VR and AR in the library, it is necessary to conduct satisfaction surveys and demand surveys. In line with previous research, Hollister and Lee (2022) investigated how libraries present and utilize VR technologies. They examined the inclusion and use of VR and related technologies in LIS curricula in the United States and South Korea. Horban, Gaisynuik, Dolbenko, Karakoz, Kobyzhcha and Kulish (2023) believe that VR and AR technologies provide access to educational materials and improve the organization of the media space in modern libraries. They emphasize that these technologies not only improve access to academic resources but also create dynamic and interactive learning environments that increase student engagement and learning outcomes.

In another study, Isa (2023) outlined the importance of AR, VR, and immersive technologies in libraries, their benefits, costs, financial implications, and strategies for overcoming challenges. This paper provides recommendations for libraries interested in incorporating VR, AR, and immersive technologies into their services. By adopting these tools, institutions demonstrate their commitment to meeting users' needs and shaping the future of knowledge dissemination and user engagement in the digital age. Academic libraries have long been important centers of society, providing resources and programs that benefit the public. The modern world is undergoing a rapid transformation in how people interact with information and technology. The emergence of VR, AR, and other immersive technologies has added a new dimension to the academic library experience. These technologies have the potential to revolutionize the interaction between libraries and their communities, offering innovative ways to support learning (Isa, 2023). Academic libraries are among the important centers that, given their audience and the types of information resources they use, are always seeking to learn from and benefit from new technological facilities. Academic libraries, as educational and research support for universities, should pay special attention to this. The user community of academic libraries consists of students, professors, graduates, and researchers, and research and education are vital issues for them. As observed in the reviewed literature, it is essential for LIS professionals, educators, and researchers to be aware of the challenges and issues associated with implementing VR and related technologies in libraries and to actively address them.

Several studies have introduced simulated reality environments, their features, and their significant impact on learning. For instance, Hannah et al. (2019) emphasized the critical need for academic libraries to collect and manage 3D objects. This research presented theoretical opportunities for libraries to develop a repository of 3D object files for use in VR and AR tools and outlined anticipated challenges. Sample (2020) highlighted the advantages of using VR technology in libraries for teaching information literacy and reducing library anxiety among non-traditional and international students, a critical task for academic libraries.

According to the literature review and the study of relevant literature from the early 1990s, when early forms of VR technology were still being tested and evaluated, the idea of using and measuring the benefits of this technology for librarians was discussed (Oppenheim, 1993). Librarians must take the lead in demonstrating to the academic community that libraries and

academic librarians have a responsibility to provide valuable resources and information. Therefore, academic librarians must provide users with new information tools and teach them how to access databases and journals for research. The librarian's role in academic libraries as an educator, researcher, and manager has remained unchanged, even as the format of content has evolved (Cerbo, 2012).

It can be said without a doubt that, with the emergence of new types and forms of information, librarians in academic libraries in developing countries need to upgrade their theoretical knowledge and practical skills and learn new strategies for organizing and disseminating these new forms of information. A review of the literature reveals no comprehensive article that extensively addresses the advantages, disadvantages, threats, and opportunities of VR applications in academic libraries. Therefore, the need to study the strengths, weaknesses, threats, and opportunities of VR in Iranian academic libraries is felt more than ever.

Materials and Methods

The present study is applied research that was conducted following a literature review and utilizing focus group methods with an analytical approach. The study's statistical population includes faculty members in departments of Library and Information Science (LIS), Medical Library and Information Science (MLIS), senior academic librarians working in both medical and non-medical academic libraries, and computer science and information technology engineers in similar settings. They also work at IT centers across Iranian universities. Due to the large population, one of the purposeful sampling methods, called Snowball sampling, was used to collect data. The snowball sampling involves pre-identified members of a group who are asked to identify other members of the target population (Creswell, 2007). As newly identified members name others, a Snowball sample is formed. This method is employed when a list of the population is not available and cannot be collected (Fink, 2011/2019: 30). Due to the lack of VR technology in Iranian academic libraries, few librarians and computer specialists in Iranian academic libraries had sufficient knowledge, mastery, and experience in using VR technology. Therefore, Snowball sampling was employed for this study.

Given the scarcity of professionals with direct experience implementing virtual reality (VR) in Iranian academic libraries, snowball sampling was employed as a pragmatic and appropriate strategy to access hard-to-reach experts (Biernacki & Waldorf, 1981). While this approach facilitated access to a specialized pool of knowledgeable participants, we acknowledge that it carries an inherent risk of homophily bias-wherein participants tend to refer individuals with similar viewpoints, institutional affiliations, or professional backgrounds, potentially limiting the diversity of perspectives. To address this limitation, we deliberately selected initial participants from diverse institutional backgrounds, including universities overseen by the Ministry of Science, Research, and Technology (MSRT) and those overseen by the Ministry of Health and Medical Education (MOHME). In these institutions, participants were selected from IT centers, academic libraries, and the LIS and MLIS departments, thereby increasing diversity in professional roles, disciplinary focuses, and organizational cultures.

Furthermore, triangulation was embedded into the study design by systematically comparing findings from the focus groups with evidence drawn from the global scholarly literature, enabling us to distinguish context-specific insights from broader trends and to identify both convergences and divergences across data sources. Throughout the research

process, reflexivity was maintained through analytical memos documenting the researchers' assumptions, positionalities, and potential biases during data collection and analysis. Collectively, these methodological safeguards were implemented to enhance the credibility, dependability, and transferability of our findings, despite the acknowledged constraints of snowball sampling in a niche professional domain.

After answering questions at the end of the data collection process, the research community introduced experts and experienced, knowledgeable individuals in VR technology to Iranian academic libraries. In this method, by identifying experts and other experienced, knowledgeable individuals, the researchers provided a reliable and trustworthy sample for the current research.

Regarding data collection methods, Stewart, Shamdasani and Rook (2007) argues that the focus group, as a social dialogue, provides researchers with more information than one-on-one interviews. This is because the group dynamics and interactions among participants lead to the introduction of new solutions. Kitzinger (1994) emphasized the importance of interaction among participants, suggesting that researchers encourage them to engage in conversation, ask questions, and comment on each other's experiences and perspectives. Since the purpose of focus groups is to create a space where people can express their feelings and attitudes toward a topic, the participation of individuals in sharing their views and experiences is crucial (Clark & Creswell, 2014). In this study, a semi-structured interview using the focus group method was employed.

A total of 19 experts were invited to form focus groups, and the process took four months. We successfully conducted interviews with nine of the invited participants, who were organized into three distinct focus groups. This methodological approach enabled us to capture a wide range of perspectives from various domains, specifically information technology employed, computer science engineering, and library and information science. By leveraging the diversity of expertise across these fields, we aimed to deepen our understanding of the subject under investigation.

The study engaged a total of 9 expert participants, organized into three focus groups based on their professional backgrounds and domain expertise. The first group consisted of three male university professors with 20 to 25 years of experience in Library and Information Sciences (LIS) and Medical Library and Information Sciences (MLIS), ensuring deep theoretical and pedagogical insight into academic library functions. The second group included three senior academic librarians - two female and one male - with 15 to 29 years of practical experience in LIS, providing grounded perspectives on service delivery, user engagement, and institutional challenges within Iranian academic libraries. The third group comprised three computer science engineers - two female and one male -each with 10 years of professional experience in information technology and software development, offering critical technical insight into the feasibility, infrastructure, and implementation barriers of VR systems. This purposive, heterogeneous sampling strategy was designed to capture multidisciplinary perspectives while mitigating homophily bias, thereby enriching the SWOT analysis with triangulated expert viewpoints from education, librarianship, and technology domains (Table 1).

Table 1

Features and specifications of focus groups

Groups	NO. of	Roles	Expertise	Gender	Experiences (Years)

	Experts			(M/F)	
1st group	3	University Professors	(LIS)/ (MLIS)	3Persons M	2 Persons/ 20 Years 1 Person/ 25 Years
2nd group	3	Senior Academic Librarians	(LIS)/ (MLIS)	2 Persons F 1Person M	1 Person/ 29 Years 1 Person/ 28 Years 1 Person/ 15 Years
3rd group	3	Computer Science Engineers	Computer Science and Information Technology	2 Persons F 1Person M	3 Persons/ 10 Years

Initially, a sheet containing information about VR and the tasks and goals of academic libraries was presented to the interviewee group, during which the interviewer provided additional explanations. Then, the groups were asked to present their viewpoints regarding VR and virtual libraries. The focus group interviews lasted between 60 and 90 minutes and comprised 14 questions (Appendix 1). During these sessions, individuals were asked general questions regarding VR, including its strengths, weaknesses, opportunities, and potential threats that may arise with the introduction of this technology into academic libraries. Moreover, idea generation occurred during the sessions, and with the interviewees' permission, the interviews were recorded and subsequently prepared for processing and analysis. To collect data in the focus group, the "idea writing" method was employed (Clark & Creswell, 2014). Participants individually wrote down their initial thoughts in response to each question before engaging in group discussion. This approach helped mitigate groupthink and ensured that quieter voices were captured. The 14 core questions and associated prompts are provided in Appendix 1. The researchers informed the research community that participation was entirely voluntary and that they could withdraw from the study at any point. They also assured them that all data would remain anonymous and confidential. By the end of the process, the audio recordings of the sessions would be deleted after implementation and coding.

In this way, the members of the focus group presented and shared their ideas in response to the researcher's questions, allowing the ideas to be refined and modified through interaction with one another. This tool was selected because the researchers needed to quickly obtain ideas and solutions related to the sub-questions. During the interview process, with the focus group members' permission, all conversations were recorded and prepared for analysis.

Given the newness of VR technology in academic libraries, the limited adoption of this technology by Iranian academic libraries, and the limited practical experience in using it in these libraries, insufficient data were obtained from the analysis of the focus group members' codes. Therefore, a literature review was selected to complete the research process. The literature review method was also used to identify, review, evaluate, and analyze articles on the implementation and use of VR technology in Iranian academic libraries' activities. A key feature of a literature review is that it provides a broader perspective on the subject. Literature reviews can help to understand a topic better, identify common themes across different studies, and even develop new theories. Petticrew and Roberts (2006) defined a systematic research review as an interpretation of selected documents on a specific topic that includes summarizing, analyzing, evaluating, and synthesizing documents. Data analysis was conducted using an inductive procedure; that is, meaningful verbal and written evidence was first recorded from

the focus group discussions and articles, and then each meaningful part was assigned a label and code that described its meaning. Each code represented a part of the events, places, feelings, experiences, and context of the study. Then, the codes were grouped into a larger category called "theme." Clark and Creswell (2014) presented this procedure for analyzing phenomenological studies.

To ensure transparency and distinguish empirical contributions from prior knowledge, all SWOT tables include two frequency columns: 'Freq. of Interviewees', which indicates how many times a theme was mentioned by participants across the three focus groups, and 'Total Freq.', which reflects the sum of interview mentions and citations in the global literature review. This dual-column format allows readers to identify which insights originate from Iranian experts and which from established scholarly discourse.

A detailed example of the coding process, illustrating the progression from raw data to final theme, is provided in Appendix 2.

Figure (1) illustrates that, after collecting data using semi-structured interview tools and conducting a literature review, the researcher first converted the recorded interviews, verbal discussions, and notes into a text document. After gaining an overview of it, he/she made initial thoughts and notes in the margins of the text. Finally, the codes were defined and categorized into themes. The analysis and classification of the obtained codes and themes were performed manually because they were not numerous.

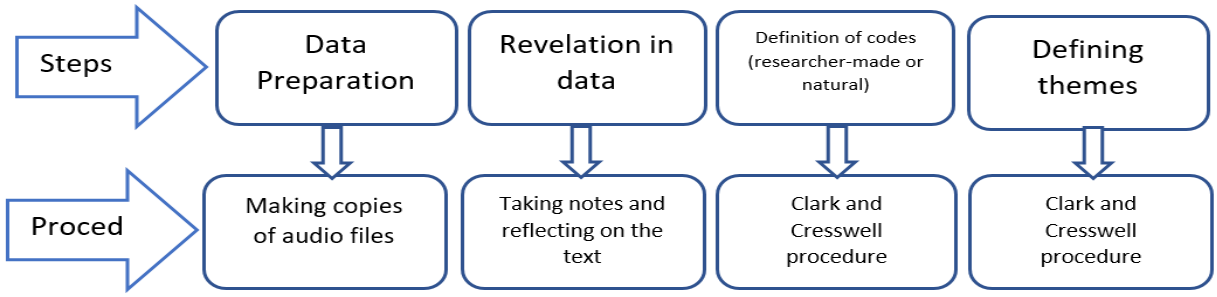

Figure 1: Steps and procedures for analyzing qualitative data (Clark & Creswell, 2014)

The SWOT study, drawing on existing literature and interviews, provides an overview of the strengths of VR technology and identifies opportunities for Iranian academic libraries. Robert Franklin Stewart, the originator of SWOT analysis, highlighted the essential role of creativity in the planning process. The SOFT/SWOT approach reduces the tendency for top-down strategy development and promotes better alignment and execution of strategies. Incorporating digital tools into the main SWOT aspects of the long-term and participatory planning process can enhance the effectiveness of strategy, communication, and organizational learning. (Puyt, Lie & Wilderom, 2023) The study offers a clear understanding of VR technology's weaknesses, highlighting potential threats that relevant individuals may face in the future. This issue enables the development of an appropriate strategy to manage and eliminate the threats effectively (Farrokhnia et al., 2024). According to the analysis, the process or structure's strengths and weaknesses are internal factors. At the same time, threats and opportunities are external factors that exist independently of the subject being analyzed. The ultimate purpose of conducting a SWOT analysis is to develop a structured assessment of the

subject under discussion, which then helps make decisions about the subject's strategic aspects (Leiber, Stensaker & Lee, 2018). A SWOT analysis can provide valuable insights for developing the assessed entities in future rounds aimed at achieving improved goals. It often includes an exploratory dimension that uncovers aspects that other analytical tools may overlook. This exploratory force stems from the need to explicitly identify and distinguish four different taxonomic dimensions of processes or structures (Leiber, 2017). The following outlines the steps for implementing the research.

The implementation stages of this research consist of seven steps: first, studying the theoretical foundations related to academic library activities using VR technology and extracting relevant research components; second, identifying the statistical population and determining the sample; third, designing and validating focus groups; fourth, forming the focus groups and analyzing the data; fifth, conducting a literature review of related articles and analyzing their data; sixth, writing codes and developing themes based on the analysis; and seventh, discussing the findings and drawing conclusions. Following the outlined methodology and implementation stages, the findings are discussed below.

To enhance the credibility, dependability, and transferability of our qualitative findings, we implemented multiple trustworthiness strategies aligned with established best practices (Lincoln & Guba, 1985; Creswell & Poth, 2018). First, the research team developed preliminary codes after open-coding the initial two focus group transcripts. These codes were then reviewed, refined, and validated through iterative discussions within the team. Second, intercoder reliability was assessed by having the team members independently code a random 20% subset of all data (including both interview transcripts and literature excerpts). The resulting Cohen's Kappa coefficient was $\kappa = 0.82$, indicating "almost perfect" agreement (Landis & Koch, 1977). Third, analytical memos were maintained throughout the research process to document emerging insights, theoretical reflections, and the researcher's positionalities. Fourth, member checking was conducted by sharing a summary of key themes with five participants (two from each librarian group and one engineer), all of whom confirmed the accuracy and resonance of the interpretations. Finally, a detailed audit trail was kept, including all versions of the codebook, raw transcripts, coding decisions, and meeting notes, to ensure transparency and enable external verification. Although analysis was conducted manually due to the manageable data volume, these procedural safeguards ensured rigorous and trustworthy qualitative analysis.

All focus group sessions were conducted online via Google Meet between January and April 2024, reflecting the geographical dispersion of participants across Iran. Each session was moderated by a designated member of the research team, with an additional team member acting as an observer and note-taker. To mitigate potential power imbalances-particularly among senior librarians, academic personnel, and engineers-the moderator explicitly fostered an environment of equal participation, utilized neutral probing questions, and emphasized that technical or hierarchical status should not influence the discussion. Participants were also reminded that all perspectives were considered equally valuable to the study's exploratory objectives.

This study received formal ethical approval from the Research Ethics Committee of Shahid Beheshti University (D-IR760.21653.14020230). Before each focus group session, participants were provided with a written information sheet detailing the study's purpose, procedures, potential risks and benefits, and their rights. Written informed consent was obtained from all participants, explicitly granting permission for the use of audio recordings, anonymized data,

and the publication of non-identifiable quotes. All interviews were conducted online via a secure Zoom platform, and recordings were stored on a password-protected university server accessible only to the research team. Participant identities were anonymized in all reporting (e.g., “Interviewee 1,” “Senior academic Librarian, Group 2”). Participants were informed of their right to withdraw from the study at any time without consequence, and no incentives were offered to avoid coercion.

Results

Using SWOT analysis in implementation and application studies enables organizations to effectively manage risks and maximize the positive outcomes of implementing VR technology. Using these findings, managers and policymakers can make comprehensive decisions regarding the implementation of VR technology in Iranian academic libraries. To achieve the objectives of this research, four questions were posed, and their answers were obtained by analyzing the collected data.

The research findings highlight several key strengths of VR technology in Iranian academic libraries. Notably, the theme of "Strengthening the cognitive, behavioral, and emotional goals of the curriculum" emerged with the highest frequency, occurring 34 times. Following this, "Strengthening users' information literacy" was noted 19 times. The theme "Strengthening virtual visits to familiarize with services, resources, and events" appeared 18 times, while "Strengthening the content element in the curriculum" was identified 16 times. These themes collectively underscore the significant potential of VR technology to enrich the educational landscape within Iranian academic libraries (Table 2).

Table 2
Strengths of VR technology in Iranian academic libraries

Rank	Theme	Freq. of Interviewees	Total Freq.
1	Strengthening the cognitive, behavioral, and emotional goals of the curriculum	12	34
2	Strengthening users' information literacy	5	19
3	Strengthening virtual visits to familiarize with services, resources, and events	4	18
4	Strengthening the content element in the curriculum	8	16
5	Strengthening users' motivation to use library services	4	9
6	Strengthening learners' content interaction	0	7
7	Designing VR-based games to enhance learning	4	4
8	Utilizing library services for users with special needs	2	3
Total		39	110

One of the items examined in the strengths is "strengthening the cognitive objectives of the curriculum." In this regard, training users in electronic security, forming an active and interactive learning environment, strengthening students' analytical skills, continuous training of medical and healthcare staff, providing immersive learning experiences for users, better understanding of abstract concepts for users of the Ministries of Health and Education, creating a calm immersive environment to prevent burnout and group experiential learning in VR for academic libraries are items that have been considered as strengths by the research community (Kouame et al., 2021; Taha, 2024; Cook et al., 2019).

As Interviewee 5 and 6 explained: 'In VR, users are placed in an almost three-dimensional environment using VR devices, such as VR helmets, and enter a completely fictional world that replaces the real world." This reflects VR's potential to strengthen cognitive learning objectives.

The improvement of wrong behaviors by indicating the consequences of wrong behavior (Interviewee 1), facilitating learning and easy access to resources for people with physical limitations (Cook et al., 2019; Lee et al., 2020), developing surgical simulations and consultations for users of medical academic libraries (Napa et al., 2019), simulating symptoms of diseases for students to better understand and provide appropriate solutions (Napa et al., 2019; Kouame et al., 2021), strengthening motor skills for dentists (Joda, Gallucci, Wismeijer & Zitzmann, 2019; Lee, 2018; Lee et al., 2022), and simulation of surgeries and visualization of organs and strengthening students' skills (Hollister & Lee, 2022; Kouame et al., 2021; Horban et al., 2023; Lessick & Kraft, 2017), are some of the items that were noted as strengths.

Interviewee 7, as a control for the case of facilitating learning and easy access to resources for people with physical limitations: "VR technology provides an opportunity for students and physically disabled people who are unable to attend academic libraries to access educational resources," and "medical students can practice on real patients in a 3D environment using VR and improve their practical skills by learning theoretical topics."

Regarding strengthening the emotional goals of the curriculum, "encouraging users to learn (Interviewee 5)," "enhancing medical student empathy with patients (Kouame et al., 2021; Lee et al., 2022)", and "developing a calm immersive environment to prevent burnout (Kouame et al., 2021)" have been mentioned.

Interviewee 5 believes that "the use of VR technology will increase the attractiveness and

effectiveness of learning and, as a result, encourage users to learn and use more medical resources."

Another item examined in the strengths is "enhancing learners' content interaction." In this regard, "enhancing user interactions with content (Kouame et al., 2021; Hollister and Lee, 2022)", "holding scientific meetings in a VR environment (Horban et al., 2023; Hollister & Lee, 2022)", "contributing to educational and research goals (Lee et al., 2020; Guan & Liang, 2015)", and "creating rooms for researchers' discussion and dialogue (Moore, Bardyn, Garrett, Ruhl & Meerovitch, 2018)" have been examined.

Regarding the strengthening of the content element in the curriculum, "the necessity of producing VR-based assets as library resources (Interviewee 1)," "saving on printing and publishing costs (Interviewee 5)," "providing high-quality content (Interviewees 5 and 6)," "equipping libraries with multi-sensory or multimedia resources (Guan & Liang, 2015)," "providing digital repositories and assets for academic libraries for loan (Hollister & Lee, 2022; Cook et al., 2019; Guan & Liang, 2015)," "conducting training courses (Lim, 2021; Hollister & Lee, 2022)," "preventing damage to valuable physical resources (Cook et al., 2019; Guan & Liang, 2015)," "providing easier access to the content of information resources for users (Interviewees 5, 7, and 8)," and as a result, "making the content more user-friendly for users to learn (Interviewee 7)" are among the issues that have been addressed.

Interviewee 1, as a control to this section: "Physical assets in many cases do not meet the need, and we need multidimensional information."

The following item mentioned in the strengths is "strengthening users' information literacy." In this regard, "increasing user participation and awareness in resource management (Hollister & Lee, 2022; Hannah et al., 2019; Interviewee 1)," "teaching information literacy concepts through virtual escape rooms (Interviewees 1, 2, and 3; Kouame et al., 2021; Hu et al., 2019; Lee et al., 2022; Lim, 2021)," "training users in using academic library services (Interviewee 1)," and "saving users' time (Lund & Wang, 2019)" have been examined.

The next item we will mention under strengths is "Strengthening virtual visits to familiarize with services, resources, and events." In this regard, "reconstruction of historical scenes in VR view (Hannah et al., 2019; Horban et al., 2023; Cook et al., 2019; Oyelude, 2018)", "Creating a virtual exhibition or museum of ancient works (Interviewees 1 and 3; Clark and Lischer, 2020)," "Opportunity to travel and reduce the costs of visiting historical and remote places for users (Hannah et al., 2019; Lee et al., 2020, Lim, 2021)" have been examined. Interviewees 1 and 3, as controls in this section: "Using VR technology, we can create a virtual exhibition or museum of ancient works for users."

The next item examined in the strengths is "strengthening users' motivation to use library services." In this regard, "improving academic library services (Interviewee 5)," "creating exhibitions and workshops to attract users to the library (Cook et al., 2019)," "entering the world of fantasy and imagination (Interviewees 5 and 8)," "increasing the number of visits and retention of academic library users (Hollister & Lee, 2022, Guan & Liang, 2015)," "increasing users' enthusiasm for communicating with librarians (Lee et al., 2020)," are among the items examined.

Interviewee 5, as a control in this section: "This allows users to act in environments that are completely fictional and fantasy-like or similar to their stories and games."

Regarding the design of VR-based games to enhance learning, only the item "gamification

of services and education" was mentioned (Interviewees 5, 1, 2, and 3). Regarding the benefits of library services for users with special needs, the interviewees mentioned the item "collective reading for the enlightened in the VR space" (Interviewees 1 and 2).

Table 3
VR Technology Opportunities in Iranian Academic Libraries

Rank	Theme	Freq. of Interviewees	Total Freq.
1	Redefining the mission of academic libraries	7	10
2	Taking advantage of opportunities for collaboration between academic libraries	1	6
3	Enhancing the nature of libraries to innovative and multi-purpose institutions	0	6
4	Providing opportunities to equip libraries with enduring digital assets	3	4
5	Providing opportunities for archivists to record and preserve traditions and events	0	2
6	Providing opportunities for students to participate in VR-based content production	2	2
Total		13	30

The main themes of the research findings that were identified as VR technology opportunities in Iranian academic libraries were: "Redefining the mission of academic libraries" with a frequency of 10, "Taking advantage of opportunities for collaboration between academic libraries" with a frequency of 6, "Enhancing the nature of libraries to innovative and multi-purpose institutions" with a frequency of 6, "Providing opportunities to equip libraries with enduring digital assets" with a frequency of 4, "Providing opportunities for archivists to record and preserve traditions and events" with a frequency of 2, and "Providing opportunities for students to participate in VR-based content production" with a frequency of 2, respectively, among the themes related to VR technology opportunities in Iranian academic libraries (Table 3).

Redefining the educational role of academic librarians (Hollister & Lee, 2022), the issue of redefining the rules governing academic libraries to accommodate the potential of VR technology (Interviewees 1 and 2), the opportunity to review the mission of academic libraries (Hannah et al., 2019) redesigning the responsibility of academic libraries regarding the organization and preservation of learning and educational resources (Hannah et al., 2019), and "Earning revenue through the creation of virtual exhibitions" (Interviewees 1, 2, and 3), are among the issues examined.

Interviewee 6, as a control in this section: "I must keep in mind that this technology will make the role of the library central in education, accepting the library as an integral part of education."

In the section on the benefits of considering opportunities for collaboration between academic libraries, it can be mentioned that academic libraries benefit from considering opportunities for collaboration with medical centers (Moore et al., 2018; Hollister & Lee, 2022), and conducting joint research, humanities and social sciences libraries (Taha, 2024).

In this case, the promotion of the nature of libraries to innovative and multi-purpose

institutions has been observed in many cases of multi-purpose and innovative learning laboratories and studios in academic libraries (Enis, 2018; Ford, 2017; Lessick & Kraft, 2017; Lutes, 2016; Williams & Nwagwu, 2025; Napa et al., 2019).

Regarding the opportunity to equip libraries with durable digital assets, it can be noted that this reduces concerns about the preservation of library works and resources (Interviewee 5) as well as the virtual lending of rare information, theses, and maps (Interviewees 1 and 3).

Interviewees 3 and 1 in this section, as controls: "We can lend out rare resources and those that are not allowed to leave the library virtually."

VR-based multimedia archives were included in the category of providing archivists with opportunities to record and preserve traditions and events (Horban et al., 2023; Sutherland, 2016). Collaboration with computer science students to address funding gaps and improve student skills was among the opportunities identified for students to participate in VR-based content production (Interviewees 3 and 9).

Despite the opportunities and strengths that VR technology brings to academic libraries, by identifying the weaknesses of this technology in the academic library environment theoretically and using previous practical and theoretical experiences and research, it is possible to try to eliminate and improve it before designing this technology in accordance with the academic library. The weaknesses of VR technology for academic libraries are "economic issues in development-support-maintenance" with a frequency of 23, "technical complexity in hardware and software equipment" with a frequency of 25, "concerns related to the physical health of users" with a frequency of 16, "issues related to technology acceptance" with a frequency of 16, "security and privacy issues" with a frequency of 10, "limited coverage of users with special needs" with a frequency of 3, "reduction of multiple human interactions (human-human-library-resources)" with a frequency of 3 (Table 4).

Table 4

Weaknesses of using VR technology in Iranian academic libraries

Rank	Theme	Freq. of Interviewees	Total Freq.
1	Economic issues in development, support, and maintenance	9	23
2	Technical complexity in hardware and software equipment	14	25
3	Concerns related to the physical health of users	7	16
4	Issues related to technology acceptance	5	16
5	Security and privacy issues	5	10
6	Lack of attention to the standardization of VR-based resources	0	5
7	Limited coverage of users with special needs	1	3
8	Reduction of multiple human interactions (human-human-library-resources)	2	3
Total		43	101

Several economic challenges in the development, support, and maintenance of virtual resources have been identified in the literature. These include content development that fails to

consider user needs and interests (Cook et al., 2019), a lack of sustainable budgets for equipment upgrades (Ellern & Cruz, 2021; Suen et al., 2020; Cook et al., 2019), and the time-intensive process of identifying and preparing virtual resource sets (Hannah et al., 2019). Additionally, the costs associated with building and maintaining virtual assets are significant (Horban et al., 2023), compounded by the high expense of VR hardware (Lee et al., 2020; Cook et al., 2019) and a shortage of trained personnel with the necessary technical skills to support VR services (Farida, Kurniasih & Kusnandar, 2025). Furthermore, securing funding and persuading management to implement such projects remains a critical barrier (Suen et al., 2020; Horban et al., 2023; Cook et al., 2019) alongside inadequate support for VR users in academic libraries (Williams & Nwagwu, 2025).

One significant weakness identified in the implementation of VR technology in academic libraries is the technical complexity of both hardware and software. This complexity is exacerbated by the need to create private, isolated spaces to effectively use VR equipment (Frost et al., 2020). Furthermore, there is often a lack of attention to users' needs during the design and implementation phases (Suen et al., 2020), which can lead to time-consuming content production within the VR landscape (Hollister and Lee, 2022; Lee et al., 2020). Physical movement limitations imposed by display and case designs further hinder user experience (Ellern & Cruz, 2021; Cook et al., 2019). The necessity for specialized hardware and software (Interviewees 5 and 7), along with an insufficient focus on the visual quality and graphics of VR software (Cook et al., 2019; Lischer-Katz et al., 2018; Horban et al., 2023), presents additional challenges. Moreover, limitations in VR software development (Lee et al., 2020) and weak support for maintaining VR hardware and software (Cook et al., 2019) further complicate the effective integration of VR technology. Lastly, access to VR resources remains restricted (Clark and Lischer, 2020) highlighting the multifaceted nature of these technical challenges.

Concerns related to users' physical health and hygiene are other issues that have been identified as weaknesses of VR technology in academic libraries. In this regard, there is the potential for theft or loss of hardware equipment (Cook et al., 2019), safety risks (Interviewee 4; Interviewee 9), and the possibility of dizziness and health problems (Lund & Wang, 2019; Hollister & Lee, 2022; Lischer, Cook & Boulden, 2018). Additionally, the lack of a horizon in the virtual world (Cook et al., 2019) and space limitations in the VR experience (Hannah et al., 2019; Hollister and Lee, 2022; Taha et al., 2024; Lischer-Katz et al., 2018) are among the issues examined.

Interviewee 4, as a control: "Excessive use of VR technology may cause health problems for some users, especially those who experience headaches and blurred vision caused by VR devices."

One of the weaknesses examined concerns technology adoption. In this context, there are several significant factors, including the limited understanding and insufficient knowledge and skills of librarians and users in utilizing VR technology (Hollister & Lee, 2022; Williams & Nwagwu, 2025; Cook et al., 2019; Lee et al., 2020), staff resistance to adopting new technologies (Suen et al., 2020; Hannah et al., 2019), and the insufficient maturity of VR technology as an educational tool for students in academic libraries (Lischer, Cook & Boulden, 2018). Additionally, the challenge of convincing senior managers to justify implementing VR technology in academic libraries has been examined (Cook et al., 2019; Clark & Lischer, 2020).

Other issues examined in the weaknesses of VR technology pertain to security and privacy concerns. Key factors include the ambiguity surrounding the ownership of content developed

for VR platforms (Hannah et al., 2019), the high probability of data disruption and hacking of VR systems (Interviewee 5), and ethical issues related to the monitoring and recording of VR users (Hollister & Lee, 2022; Ellern & Cruz, 2021; Frost et al., 2020).

Interviewee 5, as a control in this section: "VR technology involves communications between electronic devices, which increases the possibility of information disruption and hacking of systems. This issue could lead to corruption of medical data and fraud against users."

The next issue identified is the lack of attention to standardizing VR-based resources. This encompasses several significant concerns, including the absence of appropriate access standards (Clark & Lischer, 2020), issues related to the development of access protocols for VR-based resources (Hannah et al., 2019; Clark & Lischer, 2020), and the lack of specific standards for the protection of 3D information (Hannah et al., 2019). Additionally, there is insufficient attention to the standards required for integrating VR into academic libraries and the lack of standards for lending virtual assets within these institutions (Cook et al., 2019).

Among the issues mentioned regarding the limited coverage of users with special needs is the issue of "adapting the hardware of VR equipment to the capacity of the physically disabled" (Lee et al., 2020; Hollister & Lee, 2022). In this case, the literature was studied, and in the interviews, the issue of reducing face-to-face interactions and the possibility of their isolation was mentioned (Lee et al., 2020).

Interviewee 5, as a control: "The use of VR technology may reduce human interaction between the library and the user."

"Deviation of academic libraries from core functions" with a frequency of 13, "emotional decisions of managers caused by technological excitement" with a frequency of 3, "unauthorized exploitation of VR systems users' data" with a frequency of 1, and "reduction in the use of physical resources" with a frequency of 1 are among the threats associated with VR-based technology that were identified during interviews and studies of previous research (Table 5).

Table 5

Threats of VR technology in Iranian academic libraries

Rank	Theme	Freq. of Interviewees	Total Freq.
1	Deviation of academic libraries from core functions	11	13
2	Emotional decisions of managers caused by technological excitement	3	3
3	Unauthorized exploitation of users' data in VR systems	1	1
4	Reduction in the use of physical resources	1	1
Total		16	18

The deviation of academic libraries from their core functions is one of the identified threats related to VR technology in academic libraries. In this regard, "the loss of the library's core position (Interviewee 6)", "the endangerment of librarians' job positions (Interviewees 1, 2, and 8)", "the issue of the threat of changing the core identity of academic libraries due to the change in the function of technology in the library (Interviewees 2 and 1)", "the issue of redefining the job description of academic libraries (Interviewees 2 and 1)", "the dominance of this technology

over physical libraries (Interviewees 1 and 2)", "the change in the use of the library to a place for games (Ellern & Cruz, 2021; Hollister and Lee, 2022)" are among the identified issues. Managers' excitement over the excessive use of technology was among the issues identified by the interviewees (Interviewees 1, 2, and 3). The possibility of unauthorized access to data in VR systems was among the issues mentioned for the theme of unauthorized exploitation of VR users' data (Interviewee 4). The interviewee mentioned the issue of "reducing the use of physical resources" (Interviewee 5).

Discussion

The findings of this study provide valuable insights into strategic pathways for integrating VR within Iranian academic libraries. These insights are derived from the perspectives and experiences of domestic experts, complemented by an analysis of global trends. Although the study does not assess the outcomes of actual implementations, the resulting SWOT analysis presents a pragmatic framework for library administrators to systematically evaluate internal strengths and weaknesses alongside external opportunities and threats.

The results demonstrated that VR technology holds significant potential for enhancing educational, informational, and managerial services in Iranian academic libraries, findings that align with global trends reported in previous studies. While global studies confirm VR's pedagogical value (Kouame et al., 2021), our findings uniquely highlight Iranian experts' emphasis on redefining the library's mission-a strategic shift not widely reported in Western contexts. As a result, our findings represent forward-looking expert perspectives rather than evaluations based on actual implementation. Consistent with these findings, the current study confirmed that VR-based applications in Iranian libraries facilitate immersive educational environments and dynamic resource interaction, supporting the acquisition of information literacy skills, as emphasized by Hollister and Lee (2022). Moreover, our findings suggest that beyond their educational functions, VR can redefine the strategic role of academic librarians, enabling them to assume new responsibilities as curators, VR content developers, and facilitators of collaborative learning environments - a dimension seldom addressed in earlier research (Greene & Groenendyk, 2021).

Unlike previous studies that primarily focused on user-content interaction and pedagogical applications (Cook et al., 2019; Dyer et al., 2018), this study also explored managerial, strategic, and collaborative aspects of VR implementation in Iranian academic libraries. The identification of opportunities for inter-library collaboration and the development of institutional partnerships for VR initiatives marks a valuable contribution, extending the scope of existing research (Ford, 2017; Cerbo, 2012). Additionally, this study highlighted the potential of VR technology in preserving cultural heritage and documenting institutional events-a niche area that has been scarcely investigated in prior literature (Sutherland, 2016).

From a geopolitical perspective, while most existing studies have addressed VR applications in global contexts (Noh & Shin, 2022; Lischer-Katz et al., 2018; Lee et al., 2020), this study's focus on Iranian academic libraries offers an original, context-sensitive analysis of local needs, barriers, and capacities. As Farrokhnia et al. (2024) have emphasized the importance of comprehensive SWOT analyses prior to technology adoption, this study uniquely integrates an analysis of both the strengths and weaknesses of VR implementation within Iranian libraries—a gap that has been left unaddressed by many prior works.

The threats and weaknesses identified, including technological infrastructure limitations,

digital literacy challenges, and cost-related barriers, are consistent with those mentioned in the studies of Clark and Lischer-Katz (2020). However, the present study adds value by contextualizing these constraints within the Iranian higher education system and library environment, offering tailored strategic recommendations for stakeholders. This research offers original insights by bridging the educational, managerial, and strategic dimensions of VR implementation in Iranian academic libraries - a topic that has been largely neglected in the existing literature. It provides a holistic framework that examines opportunities, challenges, and librarians' roles. By integrating a localized SWOT analysis and emphasizing the strategic repositioning of libraries as multi-purpose innovation hubs, this study advances both theoretical understanding and practical guidance in the domain of library and information science.

Conclusion

The present study aims to explore the potential for integrating VR technology into Iranian academic libraries through an exploratory SWOT analysis informed by expert insights and the global literature. Conducting an implementation and application assessment, as well as a SWOT analysis (strengths, weaknesses, opportunities, and threats), is crucial prior to introducing new technologies within organizations. These processes enable managers to identify existing opportunities and challenges, facilitating informed decision-making regarding technology implementation. Given that implementation and application assessments occur in the early stages of planning, they provide a robust foundation for managers, policymakers, and domestic and foreign investors alike. Moreover, SWOT analysis highlights factors that may influence the success of such implementations.

Strengths include enhanced access to educational resources and improved learning experiences, while opportunities include potential collaborations between academic libraries and the promotion of libraries as innovative, multi-purpose institutions. Conversely, weaknesses and threats, such as economic challenges related to development, support, and maintenance, as well as emotional decision-making by managers driven by technological enthusiasm, and the diminishing use of physical resources, must be carefully addressed. Figure 2 summarizes the aforementioned issues.

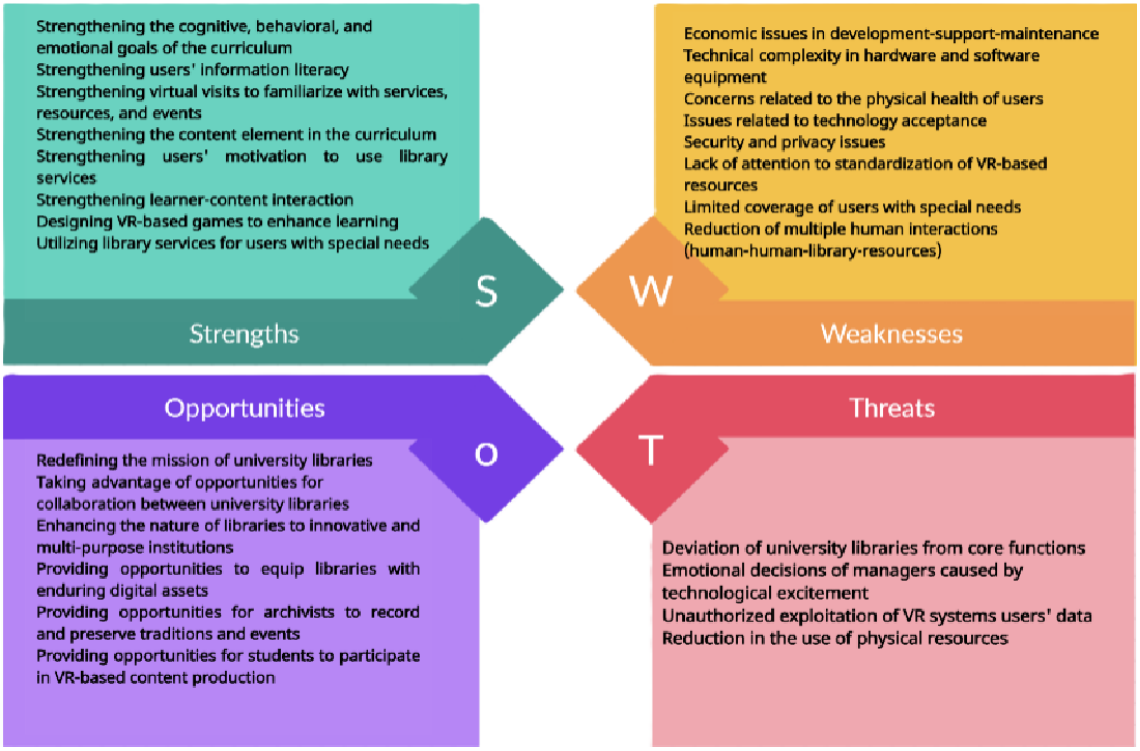

Figure 2: SWOT analysis of the VR technologies in Iranian academic libraries

The findings suggest that VR technology has the potential to enhance the cognitive, behavioral, and emotional objectives of the curriculum, improve learner-learner-content interactions, strengthen the content component of educational programs, and boost the information literacy of library users. It also facilitates virtual visits that familiarize users with cultural and historical events, increases motivation to use library services, enables the design of VR-based educational games, and provides benefits for users with special needs. The potential advantages of VR technology for academic libraries are extensive. Key opportunities include redefining the educational role of librarians, fostering collaboration between academic libraries, transforming libraries into innovative and multifaceted institutions, enabling archivists to document and preserve traditions and events, redefining the mission of libraries to equip them with enduring digital assets, and involving students in the production of VR-based content (Figure 2).

Academic libraries could potentially become hubs for innovative educational experiences, if VR is implemented with careful strategic planning. The design of interactive spaces using VR technology provides engaging, immersive educational experiences, while collaboration with universities and research institutions can lead to the development of joint innovative projects that enrich educational and research content, thereby attracting more users. Some participants expressed concerns that, in the absence of strategic planning, the introduction of VR might be perceived as a potential threat to certain traditional librarian roles. To mitigate this threat, it is essential to adopt a conscious, strategic approach to implementing VR, including training librarians in VR and redefining their roles. Moreover, it is crucial to maintain the importance of physical library spaces as venues for social interaction and face-to-face learning. This strategy can foster a more innovative and dynamic environment within academic libraries. Developing training programs for both librarians and users to familiarize them with VR technology and its optimal application is vital. These programs might comprise training courses

and practical workshops that help users and librarians understand the capabilities and limitations of VR technology. Additionally, securing financial resources through partnerships with public and private institutions to cover the costs of implementing and maintaining VR technology is essential. Funding can be secured through the presentation of research projects and collaborations with technology companies.

Another concern for librarians regarding the introduction of VR technology into academic libraries is protecting users' privacy and data security. One way to combat unauthorized data exploitation is to educate and inform users. Users should be aware of how to protect their data and use safe methods when using VR systems. These measures can include using advanced security methods, educating and informing users, and collaborating with cybersecurity experts to enhance security. With this comprehensive approach, unauthorized exploitation of user data can be largely prevented, and users' trust in VR systems can be maintained. Moreover, developing and implementing robust security and privacy policies is crucial for safeguarding users of VR technology. These policies should include solutions to protect users' personal information, prevent potential abuses, and educate librarians on how to improve and maintain the security of information and user data.

Encouraging interlibrary collaborations can also help capitalize on opportunities among academic libraries. Creating opportunities for collaboration among libraries can facilitate the sharing of resources and experiences related to VR technology and improve the quality of services provided. In addition, equipping libraries with durable digital assets and involving students in the production of VR-based content are other suggested solutions. These measures can help enhance virtual tours of library services and resources, providing archivists with opportunities to record and preserve traditions and events.

Finally, according to the findings of the present work, VR technology offers numerous opportunities for academic libraries and their users; however, it requires careful planning and proper management to ensure its optimal use. Drawing on prior practical and theoretical experience and research, it is possible to identify and address the weaknesses and threats associated with this technology while also capitalizing on its opportunities and strengths.

Limitations and directions for future research

While this study provides a context-sensitive SWOT analysis of VR adoption in Iranian academic libraries, several limitations should be acknowledged - each offering a clear direction for future research. Selection bias may have occurred due to the use of snowball sampling. Although this method was necessary to access a limited pool of VR-knowledgeable professionals in Iran, it risks homophily - where participants refer others with similar institutional backgrounds or technological perspectives. Future research should employ more diverse recruitment strategies across different regions and types of institutions to enhance representativeness.

The small sample size (n = 9) restricts the generalizability of the findings. This reflects the exploratory nature of the study, underscoring the need for a more comprehensive investigation. Therefore, larger-scale qualitative or mixed-methods studies involving librarians, computer, and IT engineers, and academic staff from multiple Iranian universities are recommended to validate and expand the SWOT framework.

Most importantly, no operational VR implementations currently exist in Iranian academic

libraries. As a result, all insights are prospective - based on expert opinions and global literature - rather than empirical evaluations of actual deployments. This gap underscores the need for pilot studies that implement small-scale VR interventions (e.g., VR-based information literacy modules or virtual library tours) and rigorously assess their impact on user engagement, learning outcomes, and service quality.

Although frequency counts were used to indicate thematic prominence, there is a risk of pseudo-quantification - a common concern when numerical data are presented without statistical analysis. To address this, future SWOT-based qualitative research should avoid ranking themes solely by frequency and instead emphasize depth of insight over apparent prevalence. While data from interviews and the literature were analyzed separately during coding, the initial manuscript drafts combined these sources in the narrative, potentially obscuring the empirical contributions of Iranian experts. This has been corrected through strict source separation in both text and tables, highlighting the need for methodological vigilance. Future studies should employ dual analytical streams from the outset and clearly distinguish findings by data source to ensure transparency.

Finally, this study was limited to Iranian academic libraries, a context marked by unique infrastructural, economic, and cultural challenges. To enhance the applicability of the findings, future research should replicate this study in public and specialized libraries within Iran and extend it to academic libraries in both developing and developed countries, facilitating cross-national comparisons. Additionally, given the growing importance of librarians in immersive environments, targeted research is vital for exploring the evolving professional roles, skills, and responsibilities of librarians in VR-based educational settings. Similarly, examining the impact of VR on information-seeking behaviors, academic performance, and accessibility for users with physical or motor disabilities warrants a thorough empirical investigation.

Despite these limitations, this study provides a foundational and future-oriented strategic framework for Iranian academic libraries to adopt VR technology. Addressing the identified gaps in future research will refine this roadmap and promote evidence-based innovation in library services.

References

Adetayo, A. J., Enamudu, A. I. & Lawal, F. M. (2021). Exploiting virtual realities for library serial services to Nigerian disabled patrons. *Library Philosophy and Practice (e-journal)*. 6494. Retrieved from https://digitalcommons.unl.edu/libphilprac/6494

Biernacki, P. & Waldorf, D. (1981). Snowball sampling: Problems and techniques of chain referral sampling. *Sociological Methods & Research*, 10(2), 141-163. https://doi.org/10.1177/004912418101000205

Calvert, P. (2019). Virtual reality as a tool for teaching library design. *Education for Information*, 35(4), 439-450. https://doi.org/10.3233/EFI-170150

Cerbo, M. A. (2012). The academic library online: Is the future of academic libraries a virtual reality? *Technical Services Quarterly*, 29(3), 181-192. https://doi.org/10.1080/07317131.2012.681278

Cheng, R., Wu, N., Chen, S. & Han, B. (2022). Will the metaverse be the next Internet? Vision, hype, and reality. *IEEE Network*, 36, 197-204. https://doi.org/10.1109/MNET.117.2200055

Clark, J. & Lischer-Katz, Z. (2020). Barriers to supporting accessible VR in academic libraries. *Journal of Interactive Technology & Pedagogy,* 17(1), 1-18. http://dx.doi.org/10.34944/dspace/6230

Clark, V. L. P., & Creswell, J. W. (2014). *Understanding research: A consumer's guide*. Boston, MA: Pearson Higher Ed.

Colegrove, P. T. (2018). Augmented and virtual reality technologies: Bridging practice and research in the academic library. *Proceedings of the Association for Information Science and Technology*, 55(1), 777-778. https://doi.org/10.1002/pra2.2018.14505501112

Cook, M., Lischer-Katz, Z., Hall, N., Hardesty, J., Johnson, J., McDonald, R. & Carlisle, T. (2019). Challenges and strategies for educational virtual reality. *Information Technology and Libraries*, 38(4), 25-48. https://doi.org/10.6017/ital.v38i4.11075

Creswell, J. W. & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th Ed.). Sage Publications.

Creswell, J. W. (2007). Qualitative inquiry & research design: Choosing among five approaches. *Sage Publications*, Thousand Oaks, CA.

Dumas, C., Williams, R. D., Flanagan, J. & Porwol, L. (2022). Implementing virtual reality training for librarians: Supporting patrons in crisis. *Proceedings of the Association for Information Science and Technology*, 59(1), 684-686. https://doi.org/10.1002/pra2.690

Dyer, E., Swartzlander, B. J. & Gugliucci, M. R. (2018). Using virtual reality in medical education to teach empathy. *Journal of the Medical Library Association*, 106(4), 498-500. https://doi.org/10.5195/jmla.2018.518

Ellern, G. (Jill) D. & Cruz, L. (2021). Black, white, and grey: The wicked problem of virtual reality in libraries. *Information Technology and Libraries*, 40(4). https://doi.org/10.6017/ital.v40i4.12915

Enis, M. (2018). VR meets the real world. *Library Journal*, 143(6), 22-25. Retrieved from https://www.libraryjournal.com/story/vr-meets-real-world-technology-focus

Farida, I. A., Kurniasih, N. & Kusnandar. (2025). A systematic review of application of augmented reality (AR) technology for visualization and management of digital assets in libraries. *Record and Library Journal*, 11(2), 441–456. https://doi.org/10.20473/rlj.V11-I2.2025.441-456

Farrokhnia, M., Banihashem, S. K., Noroozi, O. & Wals, A. (2024). A SWOT analysis of ChatGPT: Implications for educational practice and research. *Innovations in Education and Teaching International*, 61(3), 460-474. https://doi.org/10.1080/14703297.2023.2195846

Fink, A. (2019). Sampling in Surveys (J. Moghadampour, Trans.) (2019). Qom, Hammihan Publications. (Original work published 2011)

Ford, A. (2017). Spotlight: Making virtual reality a reality. *American Libraries*, 48(9-10), 20-21. Retrieved from https://americanlibrariesmagazine.org/2017/09/01/making-virtual-reality-a-reality/

Frost, M., Goates, M., Cheng, S. & Johnston, J. (2020). Virtual Reality: A survey of use at an academic library. *Information Technology and Libraries*, 39(1). https://doi.org/10.6017/ital.v39i1.11369

Greene, D. & Groenendyk, M. (2021). An environmental scan of virtual and augmented reality services in academic libraries. *Library Hi Tech*, 39(1), 37-47. https://doi.org/10.1108/LHT-08-2019-0166

Guan, C. & Liang, Y. (2015, August). Application of virtual reality technology in library. In *2015, the 1st International Symposium on Social Science* (pp. 402-405). Atlantis Press.

Hahn, J. F. (2018). Virtual reality learning environments: Development of multi-user reference support experiences. *Information and Learning Science*, 119(11), 652-661. https://doi.org/10.1108/ILS-07-2018-0069

Hannah, M., Huber, S. & Matei, S. A. (2019). Collecting virtual and augmented reality in the twenty-first-century library. *Collection Management*, 44(2-4), 277-295. https://doi.org/10.1080/01462679.2019.1587673

Hill, V. (2012). The adoption of virtual media and virtual worlds by librarians. *Advances in Library Administration and Organization*, 31(1), 89-119. https://doi.org/10.1108/S0732-0671(2012)0000031005

Hill, V. (2022). *Librarians in the metaverse support critical thinking and meta-literacy* [Video]. YouTube. https://www.youtube.com/watch?v=xUyaUlIKAOk

Hill, V., Vans, A. M. & D-Jones, A. (2017). Metaverse Libraries. Communities as resources. *Journal of Virtual Studies*, 8(2), 27-37.

Hollister, J. M. & Lee, J. (2022). An exploratory study on virtual reality and related technologies in terminal LIS degree programs in the United States and South Korea. *International Journal of Knowledge Content Development & Technology*, 12(special issue), 85-106. Retrieved from https://ijkcdt.org/ijkcdt/index.php/ijkcdt/article/view/771

Horban, Y., Gaisynuik, N., Dolbenko, T., Karakoz, O., Kobyzhcha, N. & Kulish, Y. (2023). The media space of a modern library in the context of its organizing by virtual and augmented reality technologies. *International Journal of Information and Education Technology*, 13(4), 718-723. https://doi.org/10.18178/ijiet.2023.13.4.185

Hu, J., Zhang, B. & Wang, D. (2019, July). Application of virtual reality technology in library visual information retrieval. In *IOP Conference Series: Materials Science and Engineering* (Vol. 569, No. 3, p. 032062). IOP Publishing. Https://doi.org/10.1088/1757-899X/569/3/032062

Iakovides, N., Lazarou, A., Kyriakou, P. & Aristidou, A. (2022, October). Virtual library in the concept of digital twin. In *2022 International Conference on Interactive Media, Smart Systems and Emerging Technologies (IMET)* (pp. 1-8). IEEE. https://doi.org/10.1109/IMET54801.2022.9929598

Isa, I. (2023). AR, VR, and immersive technologies: The new mode of learning and the key enablers in enhancing library services. In the *88th IFLA World Library and Information Congress (WLIC)*. Retrieved from https://repository.ifla.org/handle/20.500.14598/2684

Joda, T., Gallucci, G. O., Wismeijer, D. & Zitzmann, N. U. (2019). Augmented and virtual reality in dental medicine: A systematic review. *Computers in Biology and Medicine*, 108(2), 93-100. https://doi.org/10.1016/j.compbiomed.2019.03.012

Kitzinger, J. (1994). The methodology of focus groups: The importance of interaction between research participants. *Sociology of Health & Illness*, 16(1), 103–121. https://doi.org/10.1111/1467-9566.ep11347023

Kouame, G., Wood, E. & Orlosky, J. (2021). A Virtual Reality Library Space for Health-Centered Education and Well-Being. *Journal of Hospital Librarianship*, 21(3), 281-288. https://doi.org/10.1080/15323269.2021.1944003

Landis, J. R. & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics,* 33(1), 159–174. https://doi.org/10.2307/2529310

Lee, J., Hollister, J. M., Lim, T., Kim, K. & Ryu, J. (2022). A case review for the design of VR-based training for enhancing empathy and cultural competency of public librarians. *International Journal of Knowledge Content Development & Technology*, 12(special issue), 107-134. Retrieved from https://ijkcdt.org/index.php/ijkcdt/article/view/781/421

Lee, K. J., King, W. E., Dahya, N. & Lee, J. H. (2020). *Librarian perspectives on the role of virtual reality in public libraries*. *Proceedings of the Association for Information Science and Technology*, 57(1), e254. https://doi.org/10.1002/pra2.254

Leiber, T. (2017). Computational social science and big data: a quick SWOT analysis. In *Berechenbarkeit der Welt? Philosophie und Wissenschaft im Zeitalter von Big Data* (pp. 289-303). Wiesbaden: Springer Fachmedien Wiesbaden.

Leiber, T., Stensaker, B. & Harvey, L. C. (2018). Bridging theory and practice of impact evaluation of quality management in higher education institutions: a SWOT analysis. *European Journal of Higher Education*, 8(3), 351–365. https://doi.org/10.1080/21568235.2018.1474782

Lessick, S. & Kraft, M. (2017). Facing reality: the growth of virtual reality and health sciences libraries. *Journal of the Medical Library Association: JMLA*, 105(4), 407–417. https://doi.org/10.5195/jmla.2017.329

Lim, S. K. (2021). Virtual reality-based library user education program development. *Journal of Information Science Theory & Practice*, 9(4), 63-74. http://doi.org/10.1633/JISTaP.2021.9.4.5 [in Korean]

Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.

Lischer-Katz, Z., Cook, M. & Boulden, K. (2018). Evaluating the Impact of a Virtual Reality Workstation in an Academic Library: Methodology and Preliminary Findings. In *L. Freund (Ed.), Proceedings of the Association for Information Science and Technology* (pp. 300–308.) Hoboken, NJ: Wiley. https://doi.org/10.1002/pra2.2018.14505501033

Lund, B. D. & Wang, T. (2019). Effect of virtual reality on learning motivation and academic performance: What value may VR have for library instruction? *Kansas Library Association College and University Libraries Section Proceedings*, 9(1), 4. https://doi.org/10.4148/2160-942X.1073

Lutes, V. (2016). Texas A&M University Commerce Libraries: Check out our state-of-the-art virtual learning lab. *Computers in Libraries*, 36(10), 4-9. Retrieved from https://www.infotoday.com/cilmag/dec16/Lutes--Texas-AM-University-Commerce-Libraries-State-of-the-Art-Virtual-Learning-Lab.shtml

Massis, B. (2015). *Using virtual and augmented reality in the library*. *New Library World*, 116(11/12), 796-799. https://doi.org/10.1108/NLW-08-2015-0054

Moore, M. T., Bardyn, T. P., Garrett, A., Ruhl, D. & Meerovitch, G. (2018). *Virtual reality in academic health sciences libraries: A primer*. Seattle, WA: University of Washington Libraries.

Mystakidis, S. (2022). Metaverse. *Encyclopedia*, 2(1), 486-497. https://doi.org/10.3390/encyclopedia2010031

Napa, S., Moore, M. & Bardyn, T. (2019). Advancing cardiac surgery case planning and case review conferences using virtual reality in medical libraries: Evaluation of the usability of two virtual reality apps. *JMIR human factors*, 6(1), e12008. https://doi.org/10.1016/j.neuroimage.2023.119898

Noh, Y. & Shin, Y. (2022). A study on the plan of activation of the library by utilizing virtual reality and augmented reality. *International Journal of Knowledge Content Development & Technology*, 12(1), 85-104. Retrieved from https://ijkcdt.org/index.php/ijkcdt/article/view/645/35

Oppenheim, C. (1993). Virtual reality and the virtual library. *Information Services and Use*, 13(3), 215-227. https://doi.org/10.3233/ISU-1993-13303

Oyelude, A. A. (2018). Virtual reality (VR) and augmented reality (AR) in libraries and museums. *Library Hi Tech News*, 35(5), 1-4. https://doi.org/10.1108/LHTN-04-2018-0023

Petticrew, M. & Roberts, H. (2006). Systematic reviews in the social sciences: A practical guide. John Wiley & Sons. https://doi.org/10.1002/9780470754887

Puyt, R. W., Lie, F. B. & Wilderom, C. P. (2023). The origins of SWOT analysis. *Long range planning*, 56(3), 102304. https://doi.org/10.1016/j.lrp.2023.102304

Rajesh, P. (2022). Best practices and qualitative library services in academic libraries. *International Journal of Advance and Applied Research*, 10(1), 55-59. https://doi/org.10.5281/zenodo.7161219

Ranganathan, S. R. (1931). *The Five Laws of Library Science*. Chennai, Madras Library Association.

Sample, A. (2020). Using augmented and virtual reality in information literacy instruction to reduce library anxiety in non-traditional and international students. *Information Technology and Libraries,* 39(1), 1-33. https://doi.org/10.6017/ital.v39i1.11723

Sams, A. & Leither, L. (2021). Toward new creative services: A case study in building a virtual reality classroom in an academic library. *College & Undergraduate Libraries*, 27(2-4), 227-244. https://doi.org/10.1080/10691316.2021.1898511

Stewart, D. W., Shamdasani, P. N. & Rook, D. W. (2007). Focus groups (2nd ed.). SAGE Publications. https://doi.org/10.4135/9781412991841

Suen, R. L. T., Chiu, D. K. & Tang, J. K. (2020). Virtual reality services in academic libraries: deployment experience in Hong Kong. *The Electronic Library*, 38(4), 843-858. https://doi.org/10.1108/EL-05-2020-0116

Sutherland, T. (2016). From (archival) page to (virtual) stage: The virtual vaudeville prototype. *The American Archivist*, 79(2), 392–416.

Taha, S., Kaba, A. & Al-Qeed, M. A. (2024). Exploring students' perceptions toward the use of augmented reality for digital library services. *Digital Library Perspectives*, 40(1), 53–66. https://doi.org/10.1108/DLP-06-2023-0053

Williams, C. B. & Nwagwu, W. E. (2025). Virtual and augmented reality in the libraries: Situation analysis, hotspots and new directions. *Journal of Librarianship and Information Science,* 58(2), 980–999. https://doi.org/10.1177/09610006251332613

Appendix 1. Interview questions

1. What distinctive characteristics does VR technology possess compared to other emerging technologies (e.g., Augmented Reality)?
2. How can the adoption of VR technology support or enhance the professional roles and responsibilities of librarians in academic libraries?
3. In what ways can VR technology benefit users within academic libraries?
4. What specific skills or training do librarians need to effectively implement and manage VR-based services in academic libraries?
5. What accessibility affordances or inclusive capabilities does VR technology offer for users with physical disabilities in academic libraries?
6. What are the primary implementation challenges associated with deploying VR technology in academic libraries?
7. What factors or barriers might lead to the failure or limited success of VR technology adoption in academic libraries?
8. How might the integration of VR technology transform the nature, scope, or delivery of services in academic libraries?
9. In what ways could VR technology potentially threaten the institutional relevance or physical presence of academic libraries?
10. How might VR technology disrupt the occupational identity, job security, or professional roles of academic librarians?
11. What opportunities does VR technology create for academic libraries?
12. What threats does VR technology pose to academic libraries and their stakeholders?
13. What are the key strengths or advantages of implementing VR technology in academic libraries?
14. What are the main weaknesses or limitations of adopting VR technology in academic libraries?

Appendix 2: Sample coding process

The following excerpt illustrates the inductive coding process applied in this study, demonstrating how raw qualitative data from focus group interviews were systematically transformed into analytical themes. This example is drawn from Interviewee 7, a senior academic librarian in the medical sciences group.

Raw Data (Transcript Excerpt):

VR technology offers an opportunity for students and individuals with physical disabilities who are unable to attend academic libraries to access educational resources. For example, medical students can practice on real patients in a 3D environment using VR and improve their practical skills by learning theoretical topics.

Initial Open Codes (Generated by Research Team):

– Accessibility for users with physical disabilities
– Remote access to library resources
– VR-based clinical simulation for medical education
– Integration of theory and practice

Focused Codes (After Peer Review and Codes Refinement):

– Inclusive access to digital resources

– Experiential learning in health sciences
Final Theme (Integrated into SWOT Framework):
Strength: Utilizing library services for users with special needs
(Category: Internal Positive Factor – Strength)