

Evaluating the Effectiveness of Virtual Reality and Augmented Reality Technologies in the Training of Information Library Specialists

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Abstract: In an era dominated by information technology, the role of information library specialists has become increasingly vital. These professionals are responsible for managing, organizing, and disseminating vast amounts of information. To keep pace with the evolving landscape of libraries and information services, the training of information library specialists has also undergone significant changes. One such transformation is the integration of virtual reality (VR) and augmented reality (AR) technologies into the training process. This article explores the efficacy of VR and AR technologies in enhancing the training of information library specialists, drawing insights from scientific studies and relevant literature.

Keywords: Virtual reality; Augment reality; digital library; 3D modelling; visualization; interaction.

1. INTRODUCTION

The rapid evolution of technology has ushered in new and innovative approaches to training professionals in various fields. As information libraries and knowledge management play an increasingly critical role in the digital age, it is essential to ascertain the efficacy of emerging technologies in preparing information specialists for their roles. This study delves into the potential of VR and AR technologies to revolutionize the training process for information library specialists. It aims to evaluate the impact of these immersive technologies on learning outcomes, knowledge retention, and practical skill development. The study uses a mixed-methods approach, integrating qualitative information from surveys and interviews with quantitative measurements like knowledge evaluations. Key objectives of the study include assessing the extent to which VR and AR can simulate real-world library environments, enabling trainees to navigate complex information systems, access diverse databases, and assist library patrons effectively. Additionally, the study explores the user experience, engagement levels, and user preferences regarding the adoption of VR and AR as training tools. The findings of this research have significant implications for educational institutions, information libraries, and training programs. By comprehensively assessing the effectiveness of VR and AR technologies in the context of information library specialist training, this study offers insights that can inform curriculum development, enhance learning methodologies, and ultimately contribute to the better preparation of professionals in this vital field. As the digital landscape continues to evolve, understanding the potential of immersive technologies in

training becomes increasingly critical for ensuring the continued relevance and effectiveness of information library services.

Virtual Reality and Augmented Reality are two related but distinct technologies that create immersive digital experiences for users. They both alter the way users perceive and interact with their surroundings, but they do so in different ways. Virtual Reality is a technology that immerses users in a completely computer-generated environment, typically through the use of a headset or a pair of goggles. In a VR experience, the user is isolated from the real world and fully immersed in a virtual environment, which can be entirely fictional or a simulation of a real place. Key characteristics of VR include:

- Complete immersion: Users are cut off from the physical world and surrounded by the virtual environment, which is often three-dimensional and interactive.
- Head tracking: VR systems often track the movement of the user's head and adjust the virtual view accordingly, enhancing the feeling of presence.
- Interaction: Users can often interact with the virtual world through specialized controllers or gestures.

Examples of VR applications include gaming, virtual tourism, medical training, architectural visualization, and more.

Augmented Reality overlays digital information, such as images, videos, or 3D objects, onto the real-world environment. This is typically achieved through the use of a smartphone or AR glasses. Key characteristics of AR include:

- Real-world integration: AR does not replace the real world but enhances it by adding digital content to the user's view.
- Object recognition: AR systems can identify objects or surfaces in the real world and place digital information on or around them.
- Interaction: Users can interact with AR elements, such as tapping on a screen to access additional information.

Examples of AR applications include mobile apps that superimpose digital characters on the real world, navigation apps that provide real-time directions, and educational tools that display information on top of physical objects.

Numerous universities and research institutions around the world have conducted extensive research on VR and AR technologies. Researchers like Jeremy Bailenson at Stanford University and Mark Billinghurst at the University of South Australia have contributed to the understanding and development of these technologies.

A study by Cai and Luo (2017) examined the impact of VR on information literacy skills. The findings revealed that VR-based training improved participants' abilities to locate, evaluate, and synthesize information. By immersing trainees in realistic scenarios, VR technology allowed them to practice information retrieval and critical thinking skills in a dynamic environment.[1]

AR technologies have shown promise in promoting collaboration among information library specialists. Kamarainen et al. (2013) demonstrated that AR-enhanced collaborative learning activities facilitated communication and problem-solving skills. Trainees could work together on virtual projects, enhancing their ability to interact and exchange information effectively.[2]

Virtual simulations have become a valuable tool in the training of information library specialists. In a study by Lai et al. (2016), VR simulations were employed to train library staff in handling rare and fragile materials. Participants reported increased confidence in their ability to handle such materials after engaging in VR-based training.[3]

One of the notable advantages of VR and AR technologies is their accessibility and flexibility. Trainees can access training modules from anywhere, reducing the need for physical infrastructure. This flexibility is especially valuable in a digital age where remote learning and telecommuting are increasingly common (Mikropoulos & Natsis, 2011).[4]

While VR and AR technologies offer significant benefits, their implementation in library specialist training is not without challenges. Hardware and software costs, technical expertise, and content development can pose barriers to adoption. Additionally, the potential for sensory overload in VR environments and distractions in AR settings must be carefully managed (Milgram & Kishino, 1994).[5]

Virtual reality and augmented reality technologies are increasingly used in the training of librarians in various countries and universities around the world. These technologies offer innovative ways to enhance the knowledge and skills of librarians. While the adoption of VR and AR may not be uniform across countries and institutions, some regions and universities known for using these technologies in librarian training include:

University of Washington: The School of Information at the University of Washington is at the forefront of using VR and AR to train librarians, particularly in areas such as information visualization and deep learning experiences.
Harvard University: Harvard has explored the use of VR and AR in library and information science programs to improve research and information access.

University of British Columbia of Canada: UBC's School of Library, Archives and Information Studies has incorporated VR and AR technologies into its curriculum to prepare future librarians for the digital age.

University of Sheffield of United Kingdom: The School of Information at the University of Sheffield has been involved in research and training related to VR and AR applications in library and information science.

University of Technology Sydney of Australia: UTS has explored the use of VR and AR in library and information management programs to prepare students for emerging trends in the field.

University of Amsterdam of The Netherlands: The Faculty of Humanities at the University of Amsterdam has conducted research and experiments using VR and AR in library and information science.

National University of Singapore (NUS): NUS has explored the use of VR and AR in library science programs to provide students with hands-on experience in information retrieval and virtual libraries.

University of Tsukuba: Japanese institutions such as the University of Tsukuba have been researching VR and AR technologies and incorporating them into library and information science education.

Ewha Womans University: This South Korean university has explored the use of VR and AR technologies in library and information science programs to prepare librarians for the digital age.

Application Foundation of Virtual Reality Technology in Digital Library

The 3D modelling function of VR can create a virtual world of multiple perception such as visual, listening, sense and touch. The virtual world can be completely fictional and it can also be virtual reproduction of the reality world, namely the environment of "reality in virtualization and virtualization in reality" in virtual reality. As a result, people immersed in the sense of vision, hearing, touch, smell and so on produced in this virtual environment. VR's demand for immersion and mutual inductance requires real-time computer processing ability. The natural and harmonious human-machine interaction environment can increase immersion to experiential and change the rigid, boring and passive state between human and computer [6]. As seen in Figure 1, there are three crucial systems for the creation and use of the limited sense system from the perspective of technical realization, even though a precise definition is still lacking.

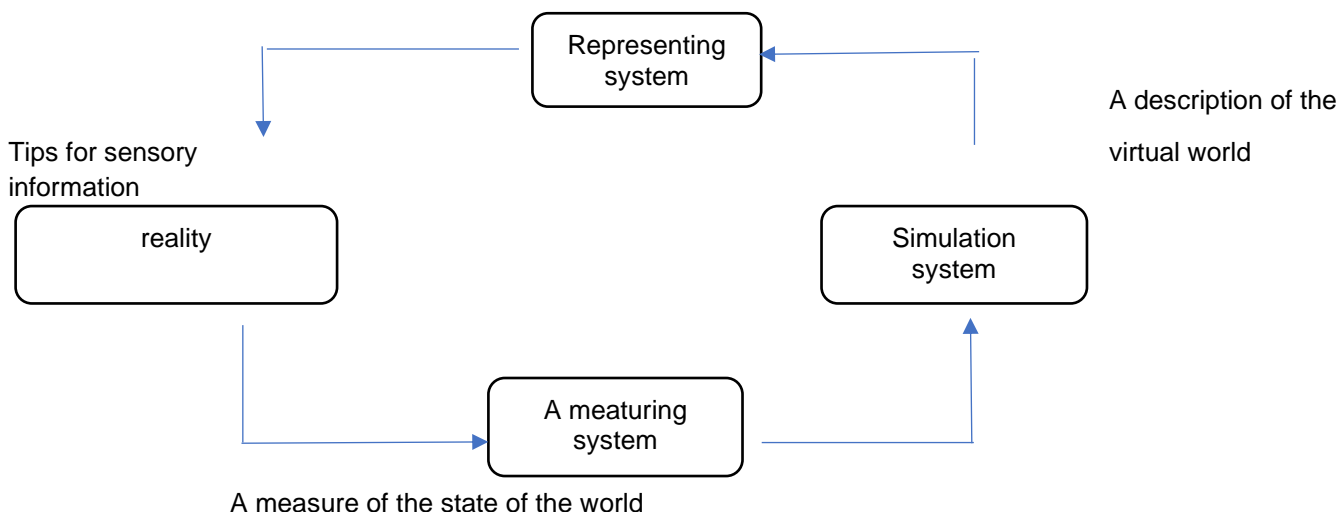


Figure. 1 Realization of the structure of virtual reality

The integration of VR and AR technologies into the training of information library specialists is an exciting development with substantial potential. Future research should focus on refining the content and delivery of VR and AR training modules, addressing accessibility concerns, and exploring innovative ways to leverage these technologies for enhanced learning outcomes.

Realization of 3D Information Resources of Digital Library Based on Virtual Reality

2. TECHNOLOGY

As the mainstream three-dimensional modelling method, virtual reality technology has very strong modelling and simulation ability so that it can be very convenient to realize the construction of three-dimensional information resources. The traditional information processing environment has always been "people adapt to computers". When virtual reality technology came into being, people began to have the concept of "computer adapts to humans", and people became the master of information processing environment, which is a brand new idea. People can participate in the information processing environment through vision, hearing, touch, smell and so on, as well as form, gesture or password, so as to get "real" experience. The system is no longer built on a single dimensional digital space, but built in a multidimensional information space. Virtual reality technology is the key technology to support this multidimensional information space [7].

Volume is introduced through the presentation of three-dimensional data, surpassing the limitations of two-dimensional data. In scientific computing, the visualization of three-dimensional data is commonly employed. Some digital libraries have used virtual reality technology to carry out the building and service of three-dimensional information resources in their digital collections. The British Library was the pioneer in the building and maintenance of three-dimensional books abroad, primarily employing display equipment to supply the priceless library collection literature.

The role of virtual reality technologies in the use of electronic libraries.

Information retrieval visualization belongs to information visualization. Information retrieval visualization refers to converting the data and its semantic relations in data set into visual display, and displaying the internal retrieval process to users. Information retrieval visualization generally includes two aspects including visualized information display and visualized information retrieval. It is mainly the visualization of information retrieval process and the visualization of retrieval results, in which the visualization of retrieval results is the most important. Computer information retrieval is closely related to the way of information organization. From the perspective of information retrieval, it can be said that the way of information organization determines the way of information retrieval [8].

Augmented reality applications in libraries

Augmented Reality integrates 3D virtual objects in a 3D real environment in real time [9]. In AR virtual objects are superimposed upon or composited with the real world, but the user can still see the real world. Therefore, AR supplements reality, rather than completely replacing it like in *Virtual Reality* (VR) [9].

A few augmented reality apps are currently available specifically for use in libraries. But the majority of them are prototypes or were created especially for a certain library. An overview of the most impressive augmented reality initiatives for libraries is given in this section. One can differentiate between many kinds of AR applications:

- applications that give library patrons more details on media (including where to get media within the library)
- apps that assist librarians (for instance, to identify books)
- applications that offer more details on the cultural resources connected to the library or archive
- augmented books.

3. CONCLUSION

The evaluation of VR and AR technologies in the training of information library specialists showcases their potential to revolutionize how professionals in this field acquire knowledge and skills. Scientific studies and literature have demonstrated that these technologies can improve information literacy, foster collaboration, and offer hands-on training experiences. However, challenges such as cost and sensory considerations must be addressed for widespread adoption. As technology continues to advance, the effective integration of VR and AR into library specialist training holds promise for ensuring that these professionals remain at the forefront of information management and dissemination in the digital age.

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DOI: <https://doi.org/10.15379/ijmst.v10i2.3297>

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