JISS Journal of Indonesian Social Science

Vol. 5, No. 11, November 2024
E-ISSN: 2723 - 6692
P-ISSN: 2723 - 6595
http://jiss.publikasiindonesia.id/

Virtual Reality Trends as a New Approach in Architecture Presentation in Indonesia: A Literature Review

Harry Wibowo, Denny Meisandy Hutauruk
Universitas Negeri Medan, Indonesia
Email: harry_ft@unimed.ac.id
Correspondence: harry_ft@unimed.ac.id

KEYWORDS
Virtual Reality; Interactive; Architecture; Visualization; Garuda

ABSTRACT
Virtual Reality (VR) is now a new trend in architectural presentations in Indonesia, offering an interactive experience that allows for a more detailed visualization of the space before construction. This study aims to explore the trend of VR adoption in Indonesia through a literature review sourced from architectural journals registered in Garba Rujukan Digital (GARUDA). The findings show that VR significantly improves spatial understanding, communication, and collaboration between architects and clients while facilitating faster decision-making. However, factors such as implementation costs and a lack of experts still hinder the widespread use of VR. The study recommends increased investment in VR training and infrastructure and encouraging closer cooperation between academia and the architecture industry to accelerate the adoption of this technology in Indonesia.

Introduction

Digital technology is growing very fast in the current era of information technology. It is applied in many fields of human life, such as education, health, transportation, and others. Digital technology in education also affects architectural design. How architects and aspiring architects work changed from the initial tools used, pencils, paper, and drawing machines, to computers and drawings. This makes product presentation and design visualization easier (Syafril, 2019).

Architects now use Virtual Reality (VR) to offer innovative design, planning, and visualization solutions. VR allows clients and stakeholders to fully experience and interact with their designs before construction is implemented. In the learning process in schools and universities, virtual reality technology has also been widely applied to architecture to help students visualize and understand complex spatial concepts. (Rauf et al., 2021), Furthermore, virtual reality has the potential to improve design and environmental understanding in architectural practices (Shih, 2000).

Virtual reality technology has the potential to revolutionize the field of architecture by providing immersive experiences, improving design outcomes, improving communication with clients, aiding in architecture education, and simulating spaces more realistically and engagingly (Jin & Zhang, 2023). Virtual reality in architecture presents a new and innovative way to display designs, allowing clients and users to fully immerse themselves in the proposed space and experience it

firsthand (Alsabban & Fatani, 2018). This approach can help overcome the limitations of traditional two-dimensional drawings and improve communication and understanding between designers, clients, and other stakeholders involved in architectural projects.

In addition, virtual reality can also be used in the construction phase to aid in the visualization and coordination of complex building processes. Virtual reality is a new technology that can potentially revolutionize the field of architecture. By creating immersive and interactive experiences, virtual reality allows architects to showcase their designs more realistically and engagingly. Virtual reality technology provides architects with new and innovative ways to present their designs, allowing clients and users to immerse themselves fully in the proposed space (Panya et al., 2020).

In Indonesia, VR in architecture is gaining attention, especially in presenting designs to clients and stakeholders. According to the latest research (Amri & Taurusta, 2021). Despite its great potential, VR adoption in Indonesia is still relatively limited compared to developed countries. The main obstacles include the high cost of implementing the technology, the lack of training and technical knowledge among architectural professionals, and inadequate infrastructure. Nevertheless, the literature shows that integrating VR in architectural presentations significantly impacts the effectiveness of communication between architects and clients and allows for early identification of design issues.

This research contributes to the field by providing a detailed analysis of the trends and obstacles related to VR adoption in Indonesian architecture, an area that has not been extensively explored. Unlike previous studies that have focused primarily on VR in developed countries, this study offers insights into the specific challenges faced in Indonesia, including cost barriers and lack of expertise. The novelty lies in the regional focus on Indonesia and the specific investigation of factors that hinder the widespread adoption of VR, providing a foundation for further research and development in this area. Moreover, the study emphasizes the need for investment in VR training and infrastructure, which could significantly impact the pace of technological adoption in the Indonesian architecture industry.

By using content analysis on the application of virtual reality in literature reviews registered in Garba Rujukan Digital (GARUDA) from 2016 to 2023, the purpose of this study is to collect information about several studies that have examined the use of virtual reality in the architecture industry. In detail, this study aims to answer the following questions: (1) How has the number of research on the use of virtual reality in architecture developed from year to year in Indonesia? (2) What are the various types of research designs used to utilize virtual reality in the field of architecture in Indonesia? (3) What are the obstacles faced in applying virtual reality in the field of architecture in Indonesia?

Research Methods

This research uses a literature review. Literature review is the process of reviewing, collecting, analyzing, and evaluating literature related to the subject being studied, according to Manzilati (2017) because it covers all types of quantitative and qualitative research, literature review is the most important first step in any research project. This study did not conduct direct field research but only analyzed data from previous studies. In the world of research, this literature review study can help researchers understand the scope of the problem to be studied, the techniques used by other

researchers to solve similar problems, the current state of research in the field, and the latest techniques proposed by the researcher.

Research Design

This study uses a content analysis approach, which focuses on research results published in scientific journals in Indonesia. The research method applied is similar to that used by (Fauzi & Pradipta, 2018).

Data Source

Data was obtained from the analysis of the content of Architecture articles. All content in the article comes from the Architecture journal registered in Garba Rujukan Digital (GARUDA), which will be updated until September 2024. GARUDA (https://garuda.kemdikbud.go.id) is a portal to find academic references in Indonesia that serves as a gateway to scientific works produced by Indonesian academics and researchers. Garuda includes domestic e-journals, conferences, and research reports. In total, ten articles were entered into the GARUDA database. This study will investigate all articles discussing virtual reality (VR) in architecture.

Data is collected from the results of content analysis in Architecture articles. All articles are taken from Architecture journals registered with Garba Rujukan Digital (GARUDA) until September 2024. GARUDA (https://garuda.kemdikbud.go.id) is an Indonesian scientific reference discovery portal that accesses scientific works produced by Indonesian academics and researchers. Garuda includes domestic e-journals, conferences, and research reports, among others. In total, ten articles are included in the GARUDA database. Furthermore, all articles reviewing virtual reality (VR) in architecture were analyzed in this study.

Research Instruments

The content analysis guidelines are instruments used in this study that include the aspects observed. In this study, four main elements are considered in content analysis. These factors include (1) the frequency of publication each year, (2) types of research, (3) Research objects, and (4) Virtual Reality topics related to Classroom Learning.

The instrument used for this study is a content analysis guideline that contains related aspects observed. There are four main aspects reviewed in the content analysis of this study. These aspects include (1) the number of publications per year, (2) type of research, (3) Research object, and (4) Virtual Reality topics related to Learning in the Classroom.

Data Analysis

Each article is classified into a specific category based on certain aspects that meet a predetermined category. The author contains this information in the abstract, method, and discussion sections. Furthermore, the collected data is presented as a bar chart.

Results and Discussion

Findings

Number of Publications

The number of articles published reflects how often research is conducted in the same period. According to the graph in Figure 1, articles on the use of virtual reality in architecture have been around since 2014. There is no particular change trend in the number of publications from one year to another. Referring to Figure 1, the number of publications since 2014 did not increase much in the following year. In 2020 and 2022, it is the most publications about virtual reality in architecture with three publications, and in 2023, there is one publication about VR in architecture.

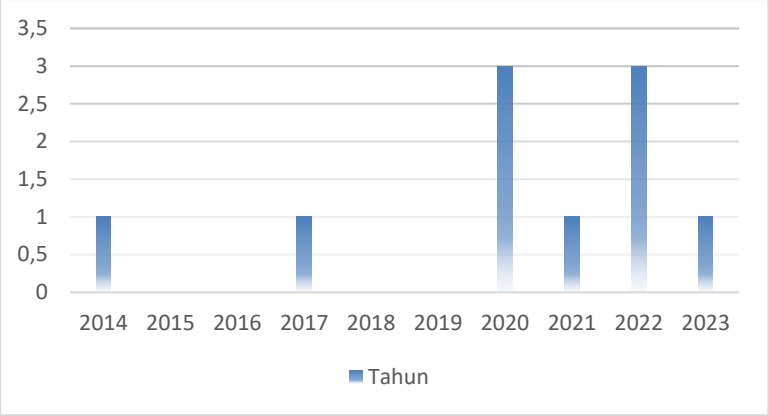

Figure 1. The Trend of Increasing the Number of Virtual Reality Technology Research in Architecture in Indonesia (GARUDA) in the Last 10 Years

Source: Data collected from content analysis of articles in Garba Rujukan Digital (GARUDA) from 2014 to 2024

The increasing number of research on virtual reality (VR) technology in the field of architecture in Indonesia has attracted attention. Over the past few years, VR has become increasingly vital in architecture, allowing experts to plan, develop, and visualize their projects more effectively and thoroughly. This increase is largely due to the sophistication of increasingly affordable and accessible technology and the understanding of the great benefits it can offer in designing and realizing architectural projects.

This increase is also supported by an increasing number of educational institutions and industries that are starting to integrate VR technology into their curricula and ongoing architectural projects. However, challenges include the cost of implementing this technology, the availability of adequate infrastructure, and the education and training required for professionals. This development promises to bring about a major change in how the architecture industry operates in Indonesia, potentially improving efficiency, creativity, and user experience in designing spaces.

Type of Research

The research type and model lead to the research's focus. According to Figure 2, qualitative research is the most commonly used design by researchers to explore virtual reality technologies in architecture. Based on some previous studies, many researchers choose qualitative research design for exploration in architecture rather than quantitative research and development research.

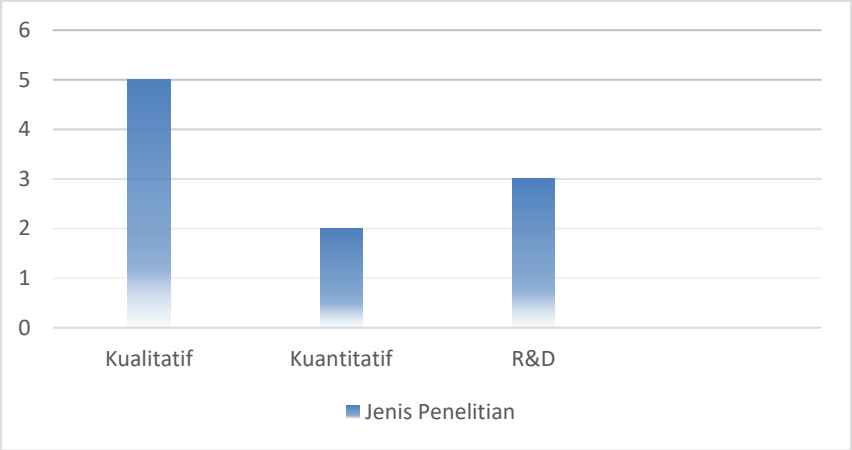

Figure 2. Distribution of Types of Virtual Reality Research in Architecture in Indonesia (GARUDA) in the Last 10 Years

Source: Data collected from content analysis of articles in Garba Rujukan Digital (GARUDA) from 2014 to 2024

R and D research is second in the research trend of virtual reality architecture, focusing on producing products through a systematic and objective data collection, processing, analysis, and presentation process. In one research in this field, a virtual reality-based desktop-based learning media for Hindu-Buddhist heritage building architecture has been created for class X of SMAN 1 Social Sciences Department, which can increase students' interest in learning (Mahendra et al., 2022). Virtual reality desktop learning media is very flexible because it can be accessed anywhere and anytime, both face-to-face and online learning in the classroom (Podkosova et al., 2022).

Quantitative research ranks third in architectural virtual reality research; quantitative research on virtual reality (VR) involves collecting numerical data and statistical analysis to understand and measure VR-related phenomena specifically. In this field, quantitative research aims to provide a solid understanding of various aspects of VR, such as user experience, design effectiveness, psychological impact, and more. This is an opportunity for architectural researchers.

Research Object

In architecture, research on virtual reality (VR) can include a wide range of objects relevant to VR applications in the industry. Based on Figure 4, the research objectives are very varied; the most discussed is about learning (Afwan, 2023; Rahmadianto et al., 2023; Syafril, 2019) and cultural heritage buildings (Bahar, 2014; Mahendra et al., 2022) as for the object of study about the house (Amri & Taurusta, 2021), Tour (Chan & Faza, 2021), general public (Hidayat & Prijotomo, 2017) and building a virtual expo (Paturusi et al., 2022), carried out 1 time (Pratowo, 2022).

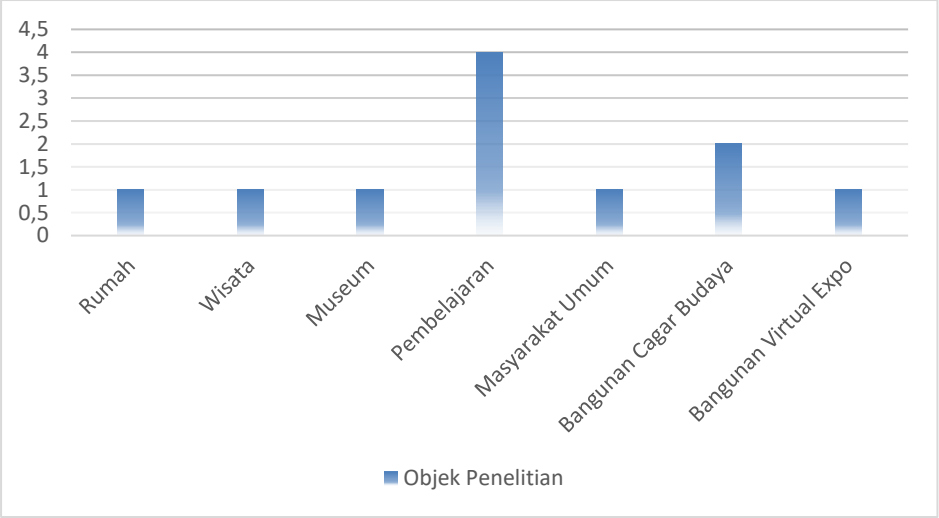

Figure 3. Distribution of Virtual Reality Research Objects in Architecture in Indonesia (GARUDA) in the Last 10 Years

Source: Data collected from content analysis of articles in Garba Rujukan Digital (GARUDA) from 2014 to 2024

Virtual Reality Topics Related to Learning in the Classroom

Of the nine articles related to virtual reality architecture, about three were related to classroom learning, and six were related to classroom learning. Among some research articles that are not related to classroom learning are

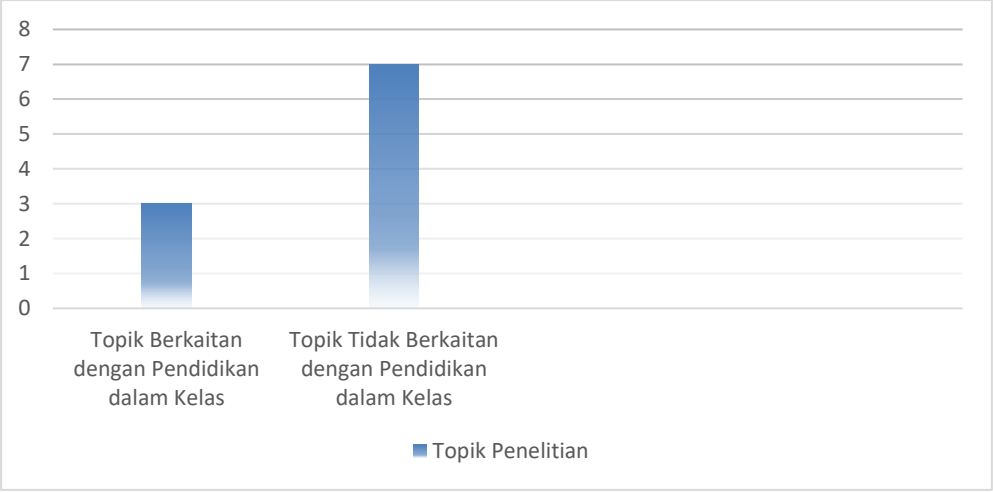

Figure 4. Distribution of Research Topics Related to Learning in Virtual Reality Classrooms in Architecture in Indonesia (GARUDA) in the Last 10 Years

Source: Data collected from content analysis of articles in Garba Rujukan Digital (GARUDA) from 2014 to 2024

The data presented in Figure 4 shows that a significant portion of virtual reality research in architecture is not directly related to classroom learning, indicating that VR is being explored more for general architectural design and presentation purposes rather than educational use. Specifically, only about one-third of the research focuses on virtual reality in the classroom setting. This disparity highlights the untapped potential of VR as an educational tool in the architecture field, suggesting a need for increased emphasis on research that explores its use in education. As virtual reality has been shown to enhance learning by providing immersive experiences, future studies could benefit from focusing on how VR can be better integrated into architectural education to support students' understanding of complex spatial concepts.

Conclusion

This research reviewed virtual reality and architecture articles published in Garba Rujukan Digital (GARUDA) from 2014 to 2024. There is a trend of increasing the number of publications that discuss VR Architecture learning, mostly quantitative research and R&D. Next is the most discussed research object about VR Architecture, which is the use of VR in learning media for students. In contrast, the overall topic that is most discussed is activities that are not related to the classroom (as a whole). Based on the findings, several suggestions have been prepared for further research because few studies, especially in Indonesia, examine the use of virtual reality for architects; this can be seen as only nine articles published from the 2014-2024 time range. Meanwhile, there are a lot of foreign articles; this is an opportunity and challenge for researchers and professional architects to use this tool in virtually presenting works to the public. Furthermore, it is recommended that other researchers conduct further research on residential objects and other commercial fungi because, in previous research, there was very little discussion about this topic. Even though for the needs of architect services Most of the projects handled by architects are private houses and commercial functions, this is important to provide new knowledge and education to the community, especially in Indonesia, regarding the use of VR in the presentation of architectural works.

References

Afwan, B. (2023). Pengembangan Media Pembelajaran Virtual Reality Berbasis Museum Klinik Santa Maria Kota Metro pada Materi Sejarah SMA. *Tarikhuna: Journal of History and History Education*, *5*(1).

Alsabban, R. F., & Fatani, M. A. (2018). Using Multimedia In Documenting And Archiving The Islamic Architectural Heritage of The Holy Mosque Area In Makkah City, Saudi Arabia. *Witpress: Transactions on The Built Environment*, *177*(12), 63–74.

Amri, F. R., & Taurusta, C. (2021). Implementasi Virtual Reality Desain Arsitektur Perumahan 3D Sebagai Media Promosi Bisnis Investasi Properti Berbasis Android. *Explorer: Journal of Coumputer Science and Information Technology*, *1*(1), 28–37.

Bahar, Y. N. (2014). Aplikasi Teknologi Virtual Realty Bagi Pelestarian Bangunan Arsitektur. *Jurnal Desain Konstruksi*, *13*(2), 34–45.

Chan, A. S., & Faza, S. (2021). Desain Virtual Reality Wisata Kota Medan Pada Era Society 5.0. *9th Applied Business and Engineering Conference*, 257–266.

Fauzi, A., & Pradipta, I. W. (2018). Research methods and data analysis techniques in education articles published by Indonesian biology educational journals. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *4*(2), 123–134. https://doi.org/10.22219/jpbi.v4i2.5889

Hidayat, S. F., & Prijotomo, J. (2017). Teknologi Virtual Reality dalam Arsitektur sebagai Bentuk Penanganan Stres Masyarakat Perkotaan pada Masa Kini. *Jurnal Sains Dan Seni ITS*, *6*(2). https://doi.org/10.12962/j23373520.v6i2.26561

Jin, H., & Zhang, N. (2023). Machinery Changes and Challenges of Architecture and Landscape Design in the Virtual Reality Perspective. *Journal of Robotics*, *2023*, 1–9. https://doi.org/10.1155/2023/1430551

Mahendra, A. D. K., Wedi, A., & Husna, A. (2022). Pengembangan desktop virtual reality arsitektur dan seni bangunan peninggalan Hindu-Buddha di Indonesia. *Jurnal Kajian Teknologi Pendidikan*, *5*(4), 412–422.

Manzilati, A. (2017). *Metodologi Penelitian Kualitatif: Paradigma, Metode, dan Aplikasi*. Universitas Brawijaya Press.

Panya, D. S., Kim, T., & Choo, S. (2020). A Methodology of Interactive Motion Facades Design through Parametric Strategies. *Applied Sciences*, *10*(4), 1218. https://doi.org/10.3390/app10041218

Paturusi, Y. A., Tinangon, A. J., & Mandey, J. C. (2022). Arsitektur Virtual Expo, Fakultas Teknik Universitas Sam Ratulangi Optimalisasi Konsep 'Virtual Reality' Dalam Berarsitekt. *Jurnal Arsitektur Daseng*, *11*(1), 115–124.

Podkosova, I., Reisinger, J., Kaufmann, H., & Kovacic, I. (2022). BIMFlexi-VR: A Virtual Reality Framework for Early-Stage Collaboration in Flexible Industrial Building Design. *Frontiers in Virtual Reality*, *3*. https://doi.org/10.3389/frvir.2022.782169

Pratowo, R. D. (2022). Penggunaan Teknologi Virtual Reality pada Perencanaan Arsitektur. *JOEICT (Journal of Education and Information Communication Technology)*, *6*(1), 17–21.

Rahmadianto, S. A., Putra Prasetya, B. P., & Soen, W. (2023). Perancangan Aset Visual 3D Virtual Reality (VR) Gedung Universitas Ma Chung Sebagai Media Pengenalan Mahasiswa Baru. *Citradirga : Jurnal Desain Komunikasi Visual Dan Intermedia*, *5*(02), 75–85. https://doi.org/10.33479/cd.v5i02.852

Rauf, H. L., Shareef, S. S., & Othman, N. N. (2021). Innovation in Architecture Education: Collaborative Learning Method Through Virtual Reality. *Journal of Higher Education Theory and Practice*, *21*(16), 33–40.

Shih, N.-J. (2000). An Application of Virtual Reality Formats in Managing Visual Information of Earthquake Damaged Sites. *International Symposium on Automation and Robotic In Construction*, 1–6.

Syafril, R. S. (2019). Penerapan Sederhana Virtual Reality Dalam Presentasi Arsitektur. *NALARs*, *19*(1), 29. https://doi.org/10.24853/nalars.19.1.29-40