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Exploring the Intersection of Virtual Reality and Interior Design: A Literature Review of Emerging Trends

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Abstract

In this digital era, virtual reality has emerged as a transformative tool across various educational fields. However, its application within interior design education remains relatively underexplored. This study examined the past studies related to the integration of VR in interior design and identified key trends. It addressed two primary research questions: (1) What were the relevant past studies concerning the application of VR in interior design? and (2) What were the prevailing trends in research on VR and interior design? Methodologically, a literature review of academic databases was conducted. The researcher focused on publications from 2020 to 2024. It resulted in 16 past studies. The findings identified VR's potential to enhance spatial awareness, foster creativity, and support sustainable design practices by enabling virtual testing of design choices. These implications underscored VR's capacity to transform interior design education by providing immersive learning experiences and facilitating client engagement in professional practice. In conclusion, while VR showed significant promise for advancing interior design, further research into its cost-effectiveness and accessibility is recommended to optimise its adoption across educational and professional contexts.

Keywords: Virtual Reality, Interior Design, Research Trend

Introduction

In the era of globalisation, accelerated by the COVID-19 pandemic, technology has become a fundamental pillar of education (Cone et al., 2022). The pandemic signified the necessity of technology in education. In addition, it aligns with the United Nations Sustainable Development Goal 4 (henceforth, SDG4) (Singh et al., 2024). The goal advocates for inclusive and equitable quality education. Consequently, the integration of technology into teaching practices has become indispensable. Among the various technology, virtual reality (henceforth, VR) has demonstrated substantial potential to revolutionise the education due to its versatility and capacity to provide immersive learning experiences (Kahlon et al., 2024).

Following that, VR has proven valuable in enhancing learning across a wide array of disciplines, ranging from language to science education. For instance, its ability to create simulated environments allows learners to engage with experiences otherwise inaccessible (Asad et al., 2021). To exemplify, VR could explore distant planets or examine molecular structures. The impact of VR on language learning is well-documented. Past studies indicated that it fostered deeper engagement and facilitated vocabulary acquisition (Chen et al., 2021; Alfadil, 2020). Finally, it could enhance motivation through interactive immersion (Guerra-Tamez, 2023). Similarly, in STEM education, VR supported a more dynamic comprehension of abstract concepts by enabling learners to interact with complex systems in three-dimensional spaces (Pellas et al., 2020).

Despite the widespread adoption of VR in different fields, its integration in interior design has lagged behind (Choh & Suh, 2023). Since 2020, there has been a discrepancy in the volume of academic publications exploring VR across different disciplines in Google Scholar. For example, VR and language have been the subject of over 203,000 publications, while science accounts for approximately 628,000. In stark contrast, fewer than 8,000 publications have focused on the use of VR in the interior design. This disparity highlights a significant gap in the investigation of the potential of VR in interior design.

Nonetheless, VR holds considerable promise for enhancing interior design education (Özgen et al., 2021). Past studies have demonstrated that VR can significantly improve learners' spatial awareness and comprehension of three-dimensional environments (Özgen et al., 2021; Tan et al., 2022). In interior design education, those utilising VR are able to virtually walk through and interact with their designs. Subsequently, they could gain invaluable insights into spatial dynamics and user experience. De Back et al. (2023) found that learners exhibited a stronger understanding of their designs and made more informed adjustments when immersed in a virtual environment. It was opposed to relying on traditional 2D blueprints or static models. Furthermore, it provides a unique platform for testing accessibility and user-friendliness (Kamińska et al., 2022). Therefore, it could enable learners to evaluate their work from the perspectives of various user groups, such as individuals in wheelchairs.

Overall, while VR is reshaping different fields, its application in the interior design, remains underdeveloped (Choh & Suh, 2023). Despite the relative scarcity of research in this area, existing past studies suggested that VR has the potential to transform the discipline by offering immersive, interactive, and practical experiences (Asad et al., 2021; Pellas et al., 2020). As VR becomes increasingly accessible, it is imperative for educators and researchers to further investigate its integration into interior design. Therefore, this study aimed to address two key research questions:

i) What were the relevant past studies concerning the application of VR in interior design?
ii) What were the prevailing trends in research on VR and interior design?

Literature Review

In this study, two key concepts were examined, namely VR and interior design. Accordingly, this section provided a review of the relevant literature on both concepts to ensure a coherent understanding of their interrelation.

Virtual Reality

VR, first conceptualised in the 1960s, has undergone significant advancements in recent years. Defined as a simulated environment created through computer technology, it enables learners to interact with and immerse themselves in virtual settings that either replicate or extend real-world experiences (Asad et al., 2021). In addition, it can be categorised primarily into non-immersive and immersive forms.

First of all, non-immersive VR allows learners to engage via standard computer interfaces. On the other hand, immersive VR facilitates full-body interaction within a digitally constructed environment. Basically, it operates with devices such as head-mounted displays (Renganayagalu et al., 2021). The key distinction between these types lies in their level of immersion. To explain, immersive VR offers more lifelike and interactive experiences. In education, VR has demonstrated considerable potential by granting learners access to experiential learning opportunities beyond the reach of traditional methods. For instance, it can simulate molecular structures or historical environments. Therefore, it provides an enriched learning experience (Scavarelli et al., 2021). The application of VR in education spans a wide range of disciplines such as science, medicine, engineering, and the arts. In anatomy education, it enables learners to explore human anatomy in three dimensions. Hence, it presents a transformative approach to medical training (Xie et al., 2021).

One notable advantage of VR in education is its capacity to enhance learner engagement and retention by fostering active, rather than passive learning environments. Past studies indicate that VR can improve both learners' performance and engagement. Consequently, it renders the learning process more memorable and motivating (Petersen et al., 2022). Furthermore, its interactive nature encourages exploration. Thereby, it could stimulate curiosity and enhance the learning experience through hands-on knowledge acquisition. In addition, VR has proven valuable in making otherwise inaccessible environments available to learners. For example, it can facilitate virtual field trips to historical sites or allow exploration of complex molecular structures. The experiences are otherwise beyond learners' reach (Yang et al., 2024). This capability makes it advantageous in subjects such as geography, where learners can explore distant or even virtual recreations of global landscapes and ecosystems.

Nevertheless, challenges remain in the widespread implementation of VR in education. The high costs associated with immersive VR and the requirement for advanced computer systems pose significant barriers. Additionally, there is a lack of comprehensive VR-based curricula across various educational systems. Eventually, it limits the integration of VR into mainstream education (Luo et al., 2021). Overall, while VR offers substantial benefits in enhancing learner engagement and accessibility, its full potential within education has yet to be fully realised. However, it is becoming increasingly accessible and practical. Therefore, it positions VR as a promising tool for future educational developments across multiple disciplines (Rojas-Sánchez et al., 2023).

Interior Design

To initiate, interior design is a multifaceted discipline focused on the creation of functional, aesthetically pleasing interior spaces that improve the quality of life and culture of the occupants. It extends beyond mere decoration. Therefore, it encompasses an

understanding of spatial planning, architecture, and human psychology to shape spaces effectively (Alkhatatbeh & Asadi, 2021). Key elements in interior design are space, color, texture, lighting, and furniture arrangement. Following that, they influence the ambiance and usability of a space (Mao et al., 2024). Effective use of these elements enhances both functional and aesthetic aspects. It aims to align design outcomes with client needs and preferences.

In recent years, interior design has gained significant importance due to growing awareness of its impact on well-being in residential, educational and commercial settings (Elenain et al., 2024). It often focusses on sustainability to consider the environmental impact and the use of eco-friendly materials (Almalki et al., 2023). The concept of “green” interior design involves minimising pollution and using sustainable resources. Following that, it aligns with the current ecological and health-conscious society. In education, interior design facilitates effective learning by incorporating elements like lighting and ergonomics that enhance concentration and comfort (Young et al., 2020).

The relevance of interior design within the industry is rapidly growing because it caters to the increasing demand for spaces that are not only visually appealing but also psychologically supportive (Dokter et al., 2021). Commercially, well-designed spaces can boost productivity and brand image. It is essential in competitive markets. Past studies show that elements like color and layout can influence human behavior and mood. Thereby, it could enhance workplace efficiency and customer satisfaction (Aboulfotouh et al., 2022).

Education is also acknowledging the importance of interior design as a professional field (Celadyn. 2020). Courses now emphasise sustainability, technological integration, and interdisciplinary approaches to prepare future designers for a dynamic industry (Tasdemir & Gazo, 2020). Building Information Modeling is among the technological advances that have transformed interior design education. It enables learners to gain practical experience in digital design and project management. The experiences are crucial in modern practice (Panteli et al., 2020).

To summarise, interior design is integral to creating spaces that align with contemporary demands for functionality, sustainability, and aesthetic appeal. With its applications expanding across various sectors, the discipline continues to evolve. Subsequently, it enhances its role in industry and education alike. This progression signifies a deeper understanding of the psychological, social, and ecological aspects of spaces. Finally, it marks the value of interior design in modern society.

Methodology

In this study, a review of relevant past studies was conducted to address the research questions. Initially, the keywords employed were [virtual reality OR VR AND interior design]. A preliminary search on Google Scholar yielded 19,200 publications without a time restriction. To refine the results, the date range was limited to publications from 2020 to 2024. Therefore, it reduced the number to 10,300. This volume remained unmanageable. Consequently, the "allintitle" search technique was applied. It narrowed the results further to 67 publications for all time periods, and to 37 for publications from 2020 onwards. Thereby, it was deemed manageable.

To improve search quality, a second round of searches was conducted using the Scopus database. The keywords were slightly modified to [virtual realit* OR VR AND interior desig*]. The search yielded 370 publications. Limiting these results to the period from 2020 to 2024 produced 73 publications. Further restriction to open-access publications reduced the total to 51. Finally, the researcher opted to focus on the most recent literature by selecting publications from 2023 to 2024. It comprised 32 studies. After a detailed review of titles and abstracts, 16 publications were identified as directly relevant to this study. One figure was presented below for better comprehension.

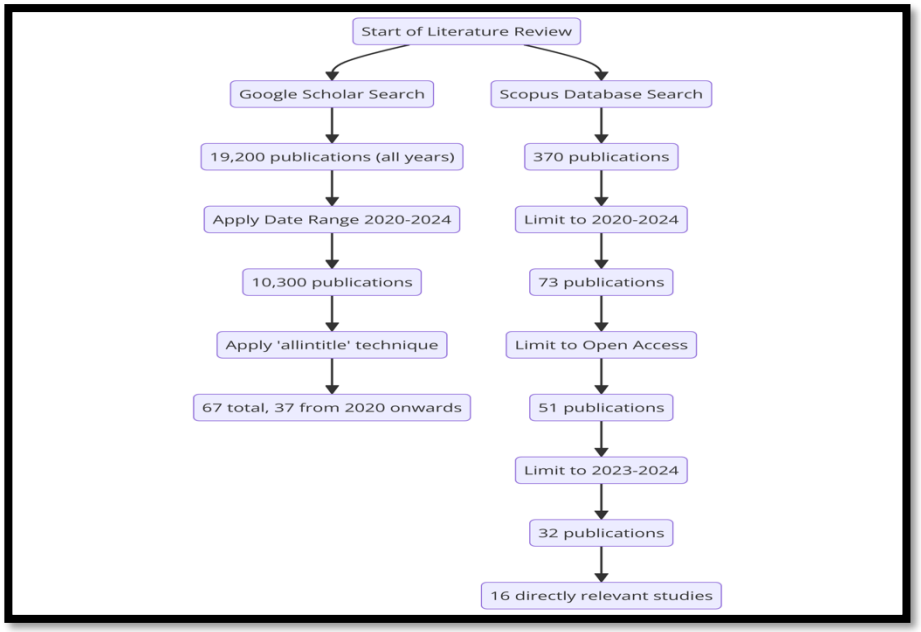

Figure 1 Flowchart of Methodology

Findings

The findings of each research question were presented accordingly in this section.

Research Question I

To revise, “what were the relevant past studies concerning the application of VR in interior design?” was the research question I. A table was shown below to answer this.

Table 1
Relevant Past Studies Identified

No.	Author(s)	Year	Purpose
1	Quan et al.	2024	Combined holographic technology and VR technology, and applied them to the interior design of digital museums and the optimization of auxiliary visits
2	Li	2024	Analysed the characteristics of interior design teaching and the features of VR technology and designed the application of VR technology in interior design teaching ideas
3	Amira El Sayed	2023	Integrated augmented reality and VR technology in interior design to achieve an interactive environment capable of developing children's skills
4	Zhang & Thienmongkol	2024	Uncovered the interactions that drive internal designing spaces into a new era of creativity and engagement with users through a thorough investigation of state-of-the-art VR tools and multimedia services and technologies
5	Wu & Han	2023	Analysed and designed an interactive interior decoration design system based on AI and VR technology
6	Meng & Lai	2023	Improved students' understanding of professional knowledge and deepened students' cognition of professional knowledge
7	Cho & Suh	2023	Compared spatial ability performance in a conventional static paper–desktop mode and an interactive VR mode
8	Ye & He	2024	Clarified the inner connection between the interior space art and the aesthetic spirit of the artistic conception of Chinese paintings, and established an appropriate theoretical basis for the construction of modern indoor space atmosphere
9	Iftekhar & Prajapati	2023	Investigated the impact of VR and eco-friendly interior design tool on carbon emission
10	Li & Lai	2023	Enhanced the innovation and attractiveness of the interior design industry and stimulated more consumption potential of interior design under the background of artificial intelligence and VR technology
11	Xiang et al.	2024	Analysed and studied the impact of interactive interior design based on VR on the emotional and psychological health of office workers

12	Su et al.	2023	Explored the innovative application of VR technology in the field of interior design, with a special focus on the integration of Dunhuang elements in design practices
13	Huang et al.	2024	Integrated Building Information Modeling (BIM) and VR technologies with performance analysis software to facilitate the selection of optimal indoor space layouts for settlement buildings
14	Tang et al.	2023	Researched the relationship between the three factors of aesthetics, ease of use, and information quality in digital marketing and consumer satisfaction
15	Wang	2024	Analysed the essential features of VR technology, constructed the framework of the interior design system based on VR technology, and designed the interaction content of the system as well as the interaction process architecture
16	Guo	2023	Developed a kind of virtual interior design system based on VR technology and divided it into two categories: One was VR based on software technology and the other was VR based on virtual hardware technology

Table 1 synthesised recent past studies on the integration and impact of VR in interior design. The research ranged from education to emotional well-being within interior design. The past studies were organised into thematic categories to provide a comprehensive overview of VR's role and potential in this field. First of all, Li (2024), examined methods for incorporating VR into interior design education. It could leverage VR's immersive qualities to enhance students' creativity and spatial awareness. Similarly, Meng and Lai (2023), found that VR tools helped students deepen their understanding of professional design concepts and spatial cognition. Beyond traditional educational settings, Amira El Sayed (2023), applied VR in child-oriented environments to create interactive spaces that foster skill development. It highlighted VR's potential to engage younger audiences through immersive experiences.

Further past studies have focused on VR's ability to enhance creativity, user engagement, and aesthetic appreciation in design. To begin, Zhang and Thienmongkol (2024), explored VR's interactive capabilities in interior design. They revealed that advanced VR tools could significantly boost user engagement and stimulate creative exploration within design spaces. Next, Ye and He (2024), expanded on VR's artistic potential by integrating elements of Chinese art. Thereby, it enriched the aesthetic value of interior spaces and provided a cultural dimension to modern design. In a similar vein, Su et al (2023), incorporated Dunhuang cultural motifs into VR-based designs. They exemplified how VR can merge technology with traditional art to create distinctive and immersive spaces.

Following that, VR's role in promoting emotional and psychological well-being has also been examined. Firstly, Xiang et al (2024), investigated VR-enabled interior designs in office

spaces. They concluded that such environments can have a positive impact on employees' mental and emotional health by fostering soothing and interactive settings. In another study, Cho and Suh (2023), compared spatial performance in VR with traditional methods. They showed that VR offered a more interactive environment for developing spatial skills. Therefore, it could benefit design professionals.

Moreover, the sustainability potential of VR in interior design has been explored as well. To start, Iftekhar and Prajapati (2023), examined VR's role in promoting eco-friendly interior design. They demonstrated how VR technology can support low-carbon design choices. Their findings underscored VR's alignment with sustainable practices in interior design. Hence, they emphasised its potential to foster environmentally conscious decision-making.

Other studies have explored VR's utility in optimising space layouts and functionality. For instance, Huang et al (2024), combined Building Information Modelling with VR to facilitate layout planning. It showcased VR's utility in achieving efficient spatial configurations. Later. Wang (2024), further developed an interactive VR-based system for interior design. It proposed a framework that enhanced user interaction and streamlined the design workflow. Guo (2023), also contributed to this field by classifying VR systems for virtual interior design. He distinguished between various software and hardware applications. This categorisation highlighted VR's adaptability to diverse design objectives. Eventually, it illustrated its flexibility for a wide range of interior design goals.

In conclusion, the reviewed past studies indicated that VR in interior design offered substantial versatility across educational, aesthetic, psychological, and environmental dimensions. It could be said that VR enhanced creativity and user engagement and optimised space layouts. Furthermore, it supported sustainable practices and demonstrated its transformative potential within interior design.

Research Question II

"What were the prevailing trends in research on VR and interior design?" was the research question II. In order to derive the research trends, a figure was displayed below with elaboration.

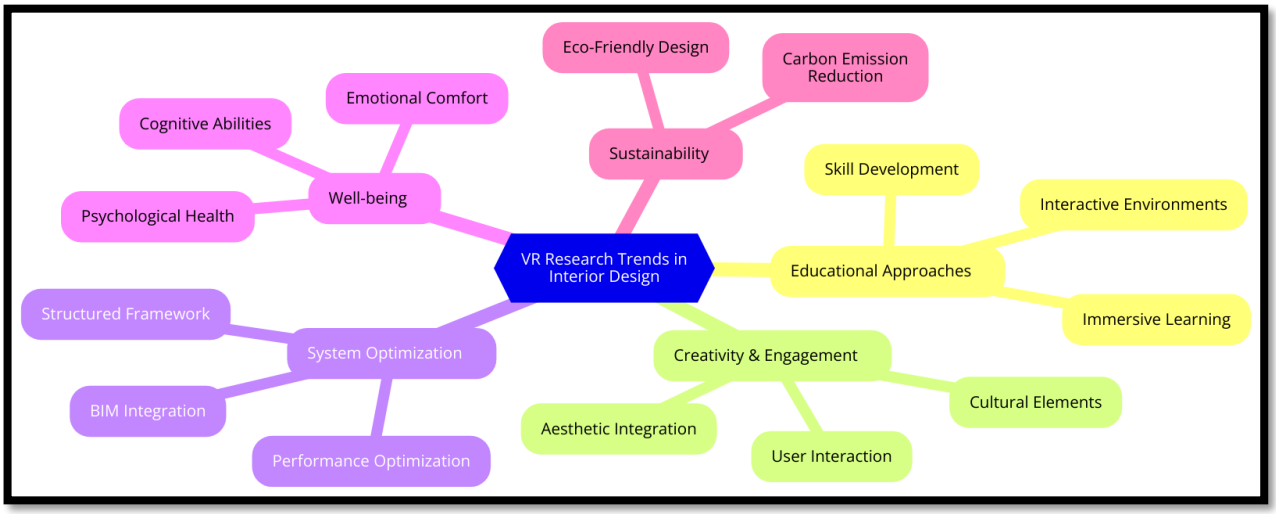

Figure 2 Research Trend

The 16 past studies revealed five key research trends. First and foremost, a prominent research trend in VR research for interior design has been its role in advancing educational approaches and skill development. For instance, Li (2024), and Meng and Lai (2023), examined VR's impact on interior design education. They demonstrated VR's ability to bridge theory and practice through immersive and interactive teaching environments. These past studies suggested that VR's immersive qualities helped deepen students' understanding of spatial concepts and strengthened their professional knowledge. Moving beyond traditional education, Amira El Sayed (2023), explored VR combined with augmented reality to create interactive environments that developed specific skills in children. Hence, it underscored VR's flexibility to support diverse age groups and learning objectives.

Another key trend has been the use of VR to enhance user engagement, creativity, and aesthetic integration in interior design. Initially, Zhang and Thienmongkol (2024), investigated VR's capacity to create interactive design spaces. They engaged users directly in the creative process. It transformed interior design into a more participatory and dynamic practice. Past studies by Ye and He (2024), and Su et al (2023), further highlighted VR's aesthetic applications by merging traditional cultural aesthetics with contemporary design. Ye and He (2024), integrated the artistic spirit of Chinese paintings into VR-facilitated design. They created a unique blend of art and digital technology, while Su et al (2023), incorporated elements from Dunhuang culture. They showcased how VR can serve as a platform for aesthetic innovation in interior design.

Moreover, past studies have also increasingly focused on VR's practical applications in optimising functionality and spatial layouts. To start, Huang et al (2024), combined Building Information Modeling with VR and performance analysis software. They showcased VR's potential in data-driven and performance-optimised design. This approach enabled designers to visualise and select ideal layouts. It was beneficial for complex projects like settlement buildings. Then, Wang (2024), contributed to this trend by developing a structured framework for VR-based interior design systems. It included an interaction process architecture. On the other hand, Guo (2023), categorised VR systems by software and hardware approaches. It highlighted VR's adaptability to meet various design needs and objectives.

Additionally, VR's impact on psychological and emotional well-being in interior design has emerged as another significant trend in workplace and therapeutic settings. For example, Xiang et al (2024), examined how VR-based interactive interior designs influenced office workers' psychological health. They indicated VR's potential to create stress-reducing and psychologically supportive environments. They suggested that VR could play a broader role in shaping spaces that enhanced emotional well-being. In addition, Cho and Suh (2023), evaluated spatial abilities in VR versus traditional modes. They provided insights into how VR might improve cognitive spatial understanding. It could in turn promote emotional comfort and engagement within interior design.

Finally, sustainability has become a growing theme in VR-based interior design research to reduce environmental impact. Iftekhar and Prajapati (2023), explored how VR could be used in conjunction with eco-friendly design principles to reduce carbon emissions. They highlighted VR's potential to support environmentally conscious design practices that addressed climate concerns. In conclusion, the prevailing research trends on VR applications in interior design underscored its diverse potential across education, creativity, functionality, emotional well-being, and sustainability. Therefore, these past studies affirmed VR's transformative impact on interior design. They fostered a more interactive, immersive, and environmentally responsible approach to the field.

Discussion

This section presented discussions for each research question accordingly

Discussion of Research Question I

The integration of VR into interior design reflected a promising trend because VR technology supported diverse applications from enhancing education and creativity to promoting psychological well-being and sustainability. The past studies synthesised in Table 1 underscored VR's versatility and transformative potential in interior design. However, while the benefits of VR in interior design were significant, they must be critically examined alongside its limitations and comparisons. Furthermore, similar applications in other fields may further elucidate both the advantages and constraints of VR in interior design.

In education, VR's immersive capabilities have proven valuable for fostering spatial awareness and creativity in interior design (Li, 2024; Meng & Lai, 2023). By allowing students to engage with spatial concepts dynamically, VR offered an advantage over traditional and static learning environments. There was a finding consistent with applications in architecture and engineering education, where VR has enabled students to visualise complex structures and assess real-world implications in a virtual space (Hajirasouli & Banihashemi, 2022). Furthermore, the use of VR in child-oriented education (Amira El Sayed, 2023) mirrored its applications in paediatric healthcare. It suggested that immersive environments have been shown to reduce anxiety and enhance skill development (Tennant et al., 2020).

However, VR's use in education is not without challenges. VR systems are often expensive and resource-intensive. It can create accessibility barriers in educational institutions (Ndjama & Van Der Westhuizen, 2025). In interior design, this financial burden may limit the availability of VR resources in smaller institutions. Additionally, the learning

curve associated with VR technology could be a hindrance for educators and students who lack prior experience in navigating virtual environments.

Beyond education, Zhang and Thienmongkol (2024) emphasised VR's ability to elevate creativity and user engagement in interior design. They noted that immersive environments stimulated design exploration and interactive engagement. This advantage extended to other creative fields, such as virtual art installations and virtual museums. It supported that VR enabled a participatory experience to allow users to explore and interact with exhibits on a deeper level (Zidianakis et al., 2021).

Similarly, VR's capacity to enhance aesthetic value through the integration of cultural motifs (Ye & He, 2024; Su et al., 2023) highlighted how VR technology can bridge cultural heritage and modern design. Nevertheless, some critics argued that VR may detract from design authenticity. In interior design, tactile experience and physical interaction with materials are essential elements often missing in VR environments. While VR could simulate spatial layouts, it lacked the ability to provide a fully realistic and multisensory experience (Melo et al., 2020). This limitation could affect designers' decision-making processes for choices that depend on sensory feedback.

Following that, VR's impact on psychological well-being and sustainability in interior design also attracted significant attention. Xiang et al (2024), demonstrated VR's positive influence on emotional well-being in office spaces. They found VR-enabled environments could create calming, interactive settings. It aligned with VR's applications in mental health, where virtual spaces have increasingly been employed in therapeutic contexts to support relaxation and anxiety management (Torous et al., 2021). Similarly, Iftekhar and Prajapati (2023) investigated VR's potential for eco-friendly design. It paralleled sustainable applications of VR in environmental planning, where virtual simulations facilitated the visualisation of environmental impacts in urban design (Nikolić & Whyte, 2021).

However, VR's effectiveness in promoting psychological well-being may vary depending on the user's tolerance for VR. The reason is that some individuals experience motion sickness or VR fatigue. They could counteract the intended relaxing effects with prolonged use (Peck et al., 2020). In terms of sustainability, the energy consumption associated with VR technology itself raises concerns. It undermined its eco-friendly applications in interior design (Rashdan & Ashour, 2024). Thus, the environmental footprint of VR must be carefully managed to ensure alignment with sustainable goals.

In short, while VR's potential in interior design is substantial, its limitations suggest the need for a balanced approach. Integrating VR into interior design can certainly foster innovation, yet designers should remain cognisant of VR's inherent constraints. It may be prudent to view VR as a complementary tool in interior design rather than a substitute for hands-on experience. Ensuring access to both VR and traditional design methods could optimise educational and professional outcomes while preserving both design authenticity and sustainability.

Discussion of Research Question II

The trends identified in VR applications for interior design underscored how VR was revolutionising educational practices, creativity, functionality, emotional well-being, and sustainability. These developments were significant because they demonstrated VR's adaptability and potential to meet complex needs not only in interior design but also in analogous fields. The insights from these trends suggested possibilities for the broader application of VR in sectors such as language education, science, and healthcare, where similar demands for interactive, immersive, and optimised environments were prevalent.

One of the major findings in interior design research was VR's role in advancing educational practices and skill development. Past studies by Li (2024), and Meng and Lai (2023), revealed VR's capability to create interactive and immersive environments that enhanced students' spatial awareness and grasp of theoretical concepts. Therefore, it made VR an invaluable tool for teaching complex subjects. This trend mirrored developments in language education (Song et al., 2023), where VR was increasingly employed to simulate immersive environments that allowed students to practise language skills contextually. Research on VR's impact in language education showed that students were more engaged and retained information better due to VR's realistic, contextual nature (Tafazoli, 2024). Similarly, in science education, VR enabled students to conduct virtual experiments in settings that would otherwise be inaccessible due to logistical or safety constraints (Srinivasa et al., 2021). These examples underscored VR's adaptability as a learning tool. They suggested that educational institutions requiring spatial awareness or contextual learning could benefit substantially from VR integration.

In addition to education, VR was found to significantly enhance user engagement and creativity. Zhang and Thienmongkol (2024), highlighted VR's ability to create interactive and dynamic experiences within interior design. They demonstrated VR's potential to transform the creative process. This shift was also evident in digital art. VR allowed users to "step into" their artwork. It led to a more immersive and engaging creative experience (Verhulst et al., 2021). Similarly, VR's integration of cultural aesthetics (Ye & He, 2024; Su et al., 2023) showcased its potential for aesthetic innovation. This trend suggested possible applications in museum curation. It was because VR was increasingly used to create culturally immersive exhibitions that enhanced visitor engagement and educational value (Li et al., 2024).

To continue, the use of VR to optimise layouts and functionality was another pivotal trend (Huang et al., 2024; Wang, 2024). VR allowed designers to visualise spatial arrangements before physical implementation. It was an approach that had already been adopted in the healthcare sector to optimise hospital layouts and workflows. It could ensure that patient care spaces were both functional and supportive of healthcare providers' needs (Hilty et al., 2020). This demonstrated VR's capacity to streamline planning processes in fields that required efficient spatial configurations. Thus, it underscored its versatility and the potential for VR to support data-driven design decisions across diverse industries.

Research by Xiang et al (2024), and Iftekhar and Prajapati (2023), also highlighted VR's impact on emotional well-being and environmental responsibility. The influence of VR on emotional health indicated potential applications in therapeutic settings. For instance, VR had been used in mental health therapy to create calming environments for individuals dealing

with anxiety. It allowed patients to practise relaxation techniques in a controlled and supportive setting (Torous et al., 2021). Additionally, VR's alignment with sustainable practices mirrored its use in environmental planning. Its simulations helped visualise eco-friendly designs and assess their long-term environmental impacts (Rashdan & Ashour, 2024). This trend underscored VR's potential to address both individual well-being and broader environmental concerns. Subsequently, it encouraged more responsible design practices.

Reflecting on these trends, it became clear that VR was facilitating a transformative shift across various fields by enabling immersive, interactive, and efficient solutions. Recognising these developments empowered designers and educators to integrate VR meaningfully into their practices. Moving forward, research should focus on addressing VR's limitations, such as VR-induced motion sickness and accessibility challenges, to ensure its benefits could be widely accessed. Expanding the understanding of VR's influence on emotional health and environmental sustainability might encourage further interdisciplinary research. It could lead to holistic applications that address both user engagement and ecological concerns.

Finally, the trends in VR for interior design demonstrated VR's potential for broader applications and highlighted its profound impact on diverse sectors. Future research and practical applications should continue to leverage VR's immersive and sustainable capabilities. They strive to maximise its benefits while addressing its challenges to create engaging and environmentally conscious experiences across various fields.

Conclusion

The trends identified in VR applications for interior design suggested numerous practical implications. First and foremost, the educational uses of VR bridging theory and practice through immersive learning environments indicated that academic institutions in design and related disciplines could significantly enhance spatial understanding and creativity by incorporating VR into their curricula (Li, 2024; Meng & Lai, 2023). By enabling virtual walkthroughs and direct interaction with design elements, VR can provide students with hands-on experiences that would otherwise be costly or logistically challenging to achieve in traditional settings. Furthermore, its impact on user engagement and creativity in design suggested that professionals could adopt VR to create more dynamic and client-centric design experiences. This technology could transform client-designer relationships by offering clients a clearer and more interactive vision of potential design outcomes (Zhang & Thienmongkol, 2024).

The implications of VR extended to therapeutic and environmental applications as well. VR's capacity to support psychological well-being in interior environments (Xiang et al., 2024) suggested its potential use in therapeutic settings. It could help create calming and customisable spaces personalised to individual needs. Additionally, VR's alignment with sustainable design practices encouraged the integration of eco-friendly principles. Therefore, it allowed designers to simulate and refine environmentally conscious interior layouts before physical implementation (Iftekhar & Prajapati, 2023). By reducing the need for physical prototypes and enabling more precise planning, VR can help minimise material waste and promote climate-conscious design decisions.

Several gaps in the current literature suggested directions for future research. First, studies exploring VR's long-term impact on learning outcomes in interior design education could provide valuable insights into the effectiveness of VR-enhanced teaching compared to traditional methods. There is also a need for research on the accessibility and scalability of VR in education for institutions with limited resources. Investigating cost-effective VR solutions, such as mobile VR setups or shared resources, could make this technology more accessible across a broader range of educational institutions.

Another promising area for research is the psychological impact of VR environments on diverse user groups. Studies could examine how different demographic groups respond to VR-enhanced interior spaces to optimise design inclusivity. Research could also focus on VR's role in promoting sustainable practices. Comparative studies evaluating the environmental footprint of VR-based design simulations versus traditional design methods would contribute to a more comprehensive understanding of VR's ecological viability in sustainable design.

Interdisciplinary studies that integrate VR into fields could further explore VR's adaptability to environments requiring immersive and interactive experiences. Such research would allow researchers to evaluate the universal principles of VR engagement and assess its influence on cognitive and emotional responses across different fields.

Following that, the prevailing trends in VR applications for interior design demonstrate VR's transformative potential across education, creativity, functionality, psychological well-being, and sustainability. These findings underscored VR's ability to foster immersive learning, enhance user engagement, and support both sustainable and therapeutic interior design practices. While VR offered substantial benefits, it was essential to balance its application with traditional methods, given challenges such as high costs, potential VR-induced motion sickness, and the technology's environmental footprint. Eventually, VR's successful integration into interior design depended on continued research and the development of innovative solutions to make VR accessible, cost-effective, and sustainable. By addressing these challenges, VR has the potential to expand its influence beyond interior design and inspiring applications that prioritise user engagement and environmental responsibility across a wide range of fields.

In conclusion, this study makes a significant contribution to both theoretical understanding and practical applications at the intersection of VR and interior design. Theoretically, it enhances the existing body of literature by synthesising the transformative potential of VR in improving spatial awareness, fostering creativity and promoting sustainability within interior design education and practice. By identifying key trends and gaps, this study establishes a framework for future exploration and bridging interdisciplinary theories of virtual environments with core interior design principles. Contextually, the findings offer valuable insights for contemporary educational and professional settings because VR becomes more accessible. This study highlights VR's capacity to address real-world challenges, such as enhancing design inclusivity, supporting psychological well-being and encouraging environmentally conscious practices. These insights pave the way for innovative applications of VR, positioning it as a critical tool for advancing both pedagogical approaches and professional practices in interior design.

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