



# Research on an Immersive Teaching Model for Interior Design Based on Virtual Reality Technology

Danna Lv<sup>a</sup> and Guoao Zhang<sup>b\*</sup>

College of Design and Art, Shenyang Jianzhu University, Shenyang, China

<sup>a</sup> 1527580251@qq.com, <sup>b\*</sup> aoo0913@163.com

**Abstract.** With the rapid development of digital technologies, Virtual Reality (VR) has been increasingly applied in education, providing new possibilities for teaching innovation. Interior design is characterized by strong spatial and practical requirements, while traditional teaching methods have certain limitations in spatial perception and interaction. To address these issues, this paper proposes an immersive teaching model based on VR technology and integrates it into interior design education. This study analyzes the current application status of VR in interior design education and summarizes key issues in technology application and teaching practice. On this basis, a teaching model integrating immersive learning, interactive experience, design practice, and feedback evaluation is constructed. Furthermore, the advantages, application principles, and innovative pathways of VR-supported teaching are systematically explored.

**Keywords:** Virtual Reality; immersive teaching; interior design; teaching model; educational innovation.

## 1 Introduction

With the rapid development of information technology, emerging technologies such as Virtual Reality (VR), artificial intelligence, and big data have been increasingly integrated into the field of education, promoting the digital transformation of education. By constructing immersive virtual environments, VR enables learners to engage in interactive experiences within three-dimensional spaces, thereby enhancing learning outcomes and transforming traditional teaching models. At present, higher education is at a critical stage of digital transformation. Interior design, as a comprehensive discipline integrating artistic design theory and practical skills, involves multiple fields such as art, technology, visual perception, and psychology, and places high demands on students' three-dimensional spatial cognition<sup>[1]</sup>. Traditional interior design teaching relies heavily on two-dimensional drawings, 3D modeling, and image-based presentation, which makes it difficult for students to form a realistic perception of space. As a result, teaching effectiveness is limited, and insufficient interaction further reduces participation and teaching quality. VR technology can help address these problems by enhancing spatial cognition and improving learning experiences. Existing studies show that VR enhances spatial understanding, creative ideation, de-

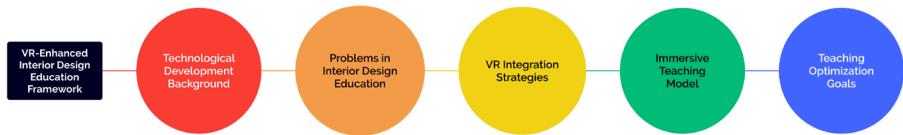
sign expression, engagement, and task performance through immersive and interactive environments. They also suggest that its effectiveness depends on the alignment of technology with learning theories, instructional tasks, and evaluation methods. However, current research still lacks systematic teaching models, deeper integration with course content, and sufficient attention to practical issues such as resource cost, faculty training, and long-term validation. Therefore, this study proposes a teaching model for interior design that integrates immersive learning, interactive experience, design practice, and feedback evaluation, aiming to provide a more operational framework for the in-depth application of VR in design education.

## **2 Overview of Virtual Reality Technology**

Virtual Reality (VR) generates three-dimensional virtual environments through computer systems and enables human–computer interaction by means of interactive devices. Its core characteristics include immersion, interaction, and imagination. Immersion refers to users' perception of environments close to reality through multi-sensory stimulation; interaction refers to the ability of users to operate within the environment in real time and receive feedback; imagination refers to the capacity to simulate real-world scenarios or construct surreal environments, thereby enriching experiential spaces. These characteristics enable VR to effectively enhance learning experiences, increase learner engagement, and provide immersive learning environments for practice-oriented courses in education.

## **3 Analysis of the Current Application Status of Virtual Reality Technology in Interior Design Teaching**

In recent years, research on the application of Virtual Reality (VR) in education started relatively early in foreign countries, mainly focusing on the construction of immersive learning environments, the evaluation of learning outcomes, and its practical application in higher education [2]. Relevant studies show that VR, through its immersive and interactive features, can improve learners' understanding of complex knowledge, increase participation, and enhance practical skills, especially in experimental teaching and spatial cognition courses. In China, VR research in education has developed rapidly, focusing on virtual simulation teaching, smart classrooms, and integrated “teaching–learning–evaluation” models. By creating immersive learning contexts, VR can optimize traditional two-dimensional teaching approaches and improve learning experience and practical ability. In design-related courses, VR has gradually been applied to interior and environmental design teaching, helping strengthen students' spatial cognition and design expression. However, its educational application still faces challenges such as high equipment costs, insufficient teaching resources, and limited teacher competence, which calls for further research on teaching model construction and practical implementation. (see Figure. 1).



**Fig. 1.** Research Logic Framework for the Integration of Virtual Reality Technology into Interior Design Teaching (Image source: self-painted by the author)

### 3.1 Major Constraints at the Level of Technology Application

Although Virtual Reality (VR) has broad prospects in education, its practical application is still constrained by several technical factors. First, the high cost of VR equipment and supporting systems limits its large-scale and routine use in universities. Second, virtual scene construction and content development are complex, requiring three-dimensional modeling, rendering, and interaction design, which increases the difficulty of resource development and maintenance. In addition, some VR systems still suffer from weak interaction design, delayed response, and unfriendly interfaces, reducing learning continuity and immersion. Moreover, insufficient adaptability across teaching scenarios, together with the lack of unified technical standards and application specifications, further restricts the in-depth integration of VR into teaching.

### 3.2 Key Issues in Teaching Practice

Traditional interior design teaching still has notable limitations, including difficulties in spatial cognition, insufficient classroom interaction, excessive reliance on PPT-based instruction, and relatively single forms of design expression. In addition, practical teaching is constrained by teaching space and material conditions, which reduces efficiency and limits the cultivation of students' practical abilities [3]. To address these problems, VR technology offers a new pathway for interior design teaching. Supported by platforms such as SketchUp, 3ds Max, and Unity3D, teachers can build virtual teaching scenarios and create simulation-based learning environments close to reality. This enables students to repeatedly practice in virtual spaces, overcoming space and material constraints while enhancing spatial cognition and improving design understanding and practical application ability.

However, the application of VR in interior design teaching is still at an exploratory stage. Some teaching cases remain at the level of visual display and have not been deeply integrated with course content, which weakens teaching effectiveness. In addition, VR is often used only as an auxiliary tool, lacking a systematic teaching model. Existing course evaluation methods still mainly rely on traditional assessment, and a scientific evaluation system for immersive learning outcomes has yet to be established.

### 3.3 Practical Difficulties and Competency Gaps in Faculty Development

The application of Virtual Reality (VR) technology in the teaching of interior design programs in universities requires corresponding development in teachers' technological literacy and instructional competence. The knowledge structure of interior design teachers is still largely dominated by design theory. Although some teachers possess solid skills in hand-drawing expression and computer-aided design drafting, they have not systematically mastered the application of VR technology<sup>[4]</sup>. On the one hand, some teachers lack a systematic understanding of VR technology and have relatively limited practical operational experience, making it difficult to effectively integrate VR into the teaching process. On the other hand, effective collaborative mechanisms between teaching practice and technology development are still insufficient, resulting in low efficiency in the construction and application of teaching resources. Therefore, improving teachers' information technology literacy and instructional integration ability has become a key link in promoting the in-depth development of VR-supported teaching.

## 4 Application of Interior Design and Immersive Learning Theory in Teaching

Interior design teaching is characterized by strong spatial and practical attributes. It depends not only on theoretical instruction but also on the cultivation of learners' spatial perception and practical design abilities. Immersive learning, centered on scenario construction and multi-sensory participation, enables learners to acquire knowledge and develop competencies through experience in real or simulated environments. Therefore, introducing immersive learning into interior design teaching can improve traditional approaches dominated by two-dimensional expression and enhance teaching effectiveness. Through three-dimensional spatial experience, students can more intuitively understand design elements such as spatial layout, material matching, and lighting effects, thereby strengthening spatial cognition. Meanwhile, immersive teaching enhances interaction and participation, promoting the shift from passive knowledge reception to active knowledge construction. Thus, the integration of interior design and immersive learning provides an important pathway for transforming design-related teaching toward an experience-driven model (see Figure. 2).

On this basis, immersive learning can function effectively in interior design education because it creates a continuous and logically connected process involving contextual perception, interactive participation, design practice, and reflective feedback. Contextualized learning provides meaningful spatial cues that help students develop an initial understanding of the design object, while immersive interaction strengthens the link between perception and operation, enabling learners to understand design elements through embodied experience. Design practice further transforms perceptual experience into problem identification, analysis, and solution exploration, while feedback and evaluation promote reflection, revision, and the consolidation of learning outcomes. Together, these stages enhance students' spatial cognition, learning en-

gement, and design competence. However, the successful implementation of immersive learning in interior design teaching also depends on practical conditions, including sufficient digital resources, accessible technological platforms, and teachers' ability to integrate technology into pedagogy. Only through the coordinated alignment of instructional content, technological support, and teacher guidance can immersive experience move beyond temporary novelty and lead to sustained educational improvement.



**Fig. 2.** Mechanism of Immersive Learning (Image source: self-painted by the author)

## 5 Application Principles and Implementation Paths of Virtual Reality-Enabled Immersive Teaching in Interior Design

In VR-enabled immersive teaching for interior design, the construction of application principles and implementation pathways should be based on practical instructional needs and promoted in an integrated manner across three dimensions: technical support, instructional organization, and collaborative assurance. At the technical level, digital course resources and platform construction are needed to provide the fundamental conditions and resource support for teaching, thereby addressing issues such as high equipment costs and insufficient instructional resources. At the instructional level, a learner-centered blended virtual–real teaching model should be developed to enhance students' spatial cognition and learning engagement through strengthened interactive experience and contextual participation. At the organizational level, interdisciplinary collaboration and faculty development mechanisms should be established to improve teachers' capacity to integrate virtual reality technology into teaching and to ensure the sustainable implementation of the model. It can thus be seen that the application principles and implementation pathways of VR-enabled immersive teaching in interior design do not operate in isolation; rather, they constitute an interconnected and progressively developed framework centered on practical teaching problems.

### 5.1 Digital Course Resources and Platform Construction

Based on VR technology, a continuously updated digital course resource system and an open virtual simulation training platform should be established to support interior design teaching. Built on three-dimensional modeling and interactive engines, the resource system can integrate images, videos, audio, and visualized 3D content into a structured teaching resource database. Around typical design tasks and teaching scenarios, virtual scenes and case resources may be developed and continuously optimized through version management and dynamic updating.

In platform construction, priority should be given to the standardized and modular management of resources so as to enable resource sharing and collaborative use across courses and teaching links. With the support of network technology and cloud platforms, teaching resources can be accessed and applied online, improving accessibility and utilization efficiency. The integration of digital resources and platform construction not only enhances the intuitiveness and visualization of teaching content, but also improves course openness, adaptability, and sustainability in VR-based interior design teaching. First, in line with the objectives of the interior design curriculum, core teaching content such as spatial layout, material representation, and lighting simulation should be modularized, and those key units most suitable for VR presentation should be clearly identified. Second, based on authentic or representative design projects, teaching tasks should be refined and translated into corresponding virtual cases and training scenarios. Third, these resources should be systematically integrated into a virtual simulation training platform, thereby creating a teaching support environment that incorporates resource access, contextual experience, task operation, and feedback on outcomes. Finally, according to teaching effectiveness and student feedback, both the resource content and platform functions should be updated on a regular basis, so as to gradually realize the continuous optimization of digital course resources and the teaching platform.

## **5.2 A Learner-Centered Blended Virtual–Real Teaching Model**

In virtual reality (VR)-based teaching environments, a learner-centered approach should be adopted while fully leveraging the instructor's guiding role, thereby establishing a teaching model that integrates virtual and real-world elements<sup>[5]</sup>. Compared to traditional teacher-centered methods, VR technology creates a more engaging and immersive learning environment through contextualized design and task-driven strategies, enabling students to construct knowledge and perform practical operations within specific scenarios.

In practice, theoretical guidance, virtual experiences, practical training, and feedback can be integrated into a teaching process consisting of “theoretical introduction—situational experience—practical training—feedback optimization.” Teachers are not only responsible for knowledge transmission but also for setting objectives, organizing activities, and regulating the learning process. Leveraging the immersive and interactive features of VR, students can engage in exploration, hands-on activities, and feedback through multisensory participation, thereby organically integrating knowledge acquisition with skill training. At the same time, instructors can provide dynamic guidance and assessment based on students' performance in the virtual environment. This learner-centered blended teaching model not only facilitates the transition from passive knowledge reception to active knowledge construction but also enhances spatial comprehension, learning engagement, and comprehensive design capabilities (Table 1).

**Table 1.** Elements of Learner-Centered Immersive Interactive Teaching.

Dimension	Content	Function
Teaching Philosophy	Learner-centered, emphasizing subjectivity and participation	Enhances learning initiative
Instructional Design	Task-driven and scenario-based design	Strengthens learning purposefulness and contextuality
Learning Process	Combination of exploration, operation, and feedback	Promotes the integration of knowledge and skills
Technical Support	Utilization of VR's immersion and interactivity	Improves spatial understanding and learning engagement
Instructional Regulation	Teachers dynamically adjust teaching based on feedback	Enhances teaching adaptability and effectiveness
Competency Development	Emphasis on autonomous learning and problem solving	Promotes deep learning and competency improvement

### 5.3 Mechanisms for Interdisciplinary Collaboration and Faculty Development

The effective application of virtual reality (VR) in interior design education depends on interdisciplinary collaboration and the enhancement of faculty capabilities. As VR instruction involves design, computer technology, and education, multidisciplinary cooperation is necessary to promote the integration of technology and teaching content. Interdisciplinary teams composed of design faculty, IT professionals, and researchers can jointly support curriculum development, platform construction, and case design. At the same time, industry-academia-research collaboration should be encouraged to introduce corporate and industry resources into virtual platform development and practical projects, thereby strengthening the applied value of teaching content. Improving teachers' digital teaching competence is also essential for the effective implementation of VR instruction. Although some interior design instructors possess solid professional foundations and digital design skills, their understanding and application of VR technology remain insufficiently systematic, and effective connections between teaching practice and technological development are still lacking.

Faculty members are not only transmitters of knowledge but also organizers and facilitators of the teaching process; they play a pivotal role in setting course objectives, arranging instructional content, and designing learning activities [6]. Higher education institutions should utilize specialized training, project-based practice, and collaborative professional development to enhance instructors' IT literacy, instructional integration skills, and resource development capabilities, enabling them to effectively integrate VR technology into course design and teaching implementation. Establishing interdisciplinary collaboration mechanisms and improving instructors' technical application skills will not only enhance the efficiency of VR teaching resource development and application but also drive innovation in teaching models and improve the quality of talent cultivation, laying the foundation for the continued deepening of virtual reality technology applications in interior design education (see Figure. 3). At the practical level, faculty development should move beyond one-off

lectures or short-term training sessions and toward sustained collaborative teaching, technical mentoring, and project-based support. This is because teachers' level of preparedness directly determines whether VR can be effectively integrated into curriculum design, rather than being used only as a tool for visual display.



**Fig. 3.** Diagram of the Interdisciplinary Collaboration Mechanism for VR Interior Design Education (Image source: self-painted by the author)

## 6 Conclusion

This paper examines the application of virtual reality technology in interior design education and identifies key challenges in spatial cognition, practical training, and instructional interaction. It proposes an immersive teaching model supported by immersive learning theory, integrating contextualized learning, interactive experience, design practice, and feedback evaluation, which helps enhance students' spatial cognition and learning engagement. In addition, a series of optimization strategies are suggested from the perspectives of teaching principles and innovation pathways, providing support for the transformation of interior design teaching from a knowledge-transfer model to an experience-driven model. However, the current application of VR in teaching is still at an early stage, and further research is needed on teaching model refinement, resource development, and evaluation systems. Future efforts should focus on strengthening the integration of technology and education to promote the high-quality development of VR in design. Virtual reality technology can, to some extent, overcome the limitations of traditional interior design teaching in spatial perception, practice, and classroom interaction, thereby enhancing students' spatial cognition, learning engagement, and design competence. This study also proposes optimization strategies in digital resources and platforms, learner-centered blended teaching, and interdisciplinary faculty development, providing theoretical and practical support for transforming interior design teaching from a knowledge-transmission model to an experience-driven model.

## References

1. Tang, L., Peng, Y., Luo, S.: Analysis of innovative strategies for interior design teaching based on virtual reality technology. *Keji Chuangxin yu Shengchanli* 44(06), 19–21, 25 (2023)
2. Wu, P., Zhang, W., Li, P., Liu, Y.: The application of VR in interior design education to enhance design effectiveness and student experience. *Displays* 90, 103161 (2025). DOI: 10.1016/j.displa.2025.103161.
3. Pan, Y.: Integration and application of virtual reality technology in interior design courses. *Art Education* (20), 67–68 (2018)
4. Chen, Y.: Research on the path of virtual reality technology empowering the teaching reform of interior design majors in colleges and universities. *Shanghai Packaging* (08), 253–255 (2025). <https://doi.org/10.19446/j.cnki.1005-9423.2025.08.081>
5. Huh, M.B., Miri, M.: The effects of using VR to promote student motivation in architectural design studio course. *International Journal of Design Creativity and Innovation* 13(3), 221–244 (2025). DOI: 10.1080/21650349.2025.2471973.
6. Wang, C.: Exploration of online–offline blended teaching model for computer courses in secondary vocational schools. *Computer Knowledge and Technology* 16(06), 148–149 (2020). <https://doi.org/10.14004/j.cnki.ckt.2020.0680>

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

