### **Environmental Design and Teaching Interaction: Creating Immersive Learning Experiences**

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Abstract: This paper examines how environmental design and teaching interaction collaborate to create immersive learning experiences, thereby enhancing teaching quality and student outcomes. The aim is to develop a theoretical framework analyzing the characteristics of immersive teaching from an environmental design perspective and its practical applications in modern education. The study employs literature review and theoretical analysis, examining design elements and interaction models in immersive educational environments. It begins with defining immersive teaching, explores the influence of environmental design through theoretical proposes models, and optimization strategies in specific teaching contexts. The analysis reveals that immersive teaching relies not only on technological support but also on carefully designed environments to enhance learner immersion and engagement. These environments incorporate elements like virtual reality, sensory stimuli, and interactive media, which collectively boost learner initiative and creativity, while facilitating knowledge internalization and transfer. This research provides я theoretical foundation and practical guidance for future educational reforms and environmental design, aiming to optimize immersive teaching environments to improve overall educational quality and drive innovation.

Keywords: Environmental Design; Immersive Learning; Teaching Interaction; Virtual Reality; Educational Reform

#### 1. Introduction

#### 1.1 Background and Significance

In the 21st century, rapid technological advancements have transformed education, rendering traditional teaching methods insufficient for meeting students' growing needs. Immersive learning, leveraging technologies like Augmented Reality (AR) and Virtual Reality (VR), offers a novel educational experience (Wei & Zhang, 2023). This approach not only supplements traditional methods but also represents a paradigm shift, enhancing student engagement and enabling personalized education. Exploring the role of environmental design and teaching interaction in immersive learning is thus of significant practical and theoretical value.

#### 1.2 Literature Review

Research on immersive learning has made notable progress. Chen Xiaoqing (2024) highlighted the impact of Quest3D technology on virtual learning systems at Shanghai University. Internationally, U.S. Normal universities have successfully integrated VR in medical and engineering education. However, despite extensive studies, a unified theoretical framework for the synergy between environmental design and teaching interaction Most research focuses is lacking. on technological innovation, with insufficient exploration of systematic environmental design (Wang & Li, 2021).

#### **1.3 Research Objectives and Questions**

This study aims to develop a framework for the application of environmental design in immersive learning through theoretical analysis and literature review. Key research questions include: What are the definitions and implications of immersive learning? How does environmental design affect learning outcomes? How can teaching interaction be optimized in learning? immersive Addressing these questions will provide a practical theoretical paradigm for advancing educational innovation.

#### **1.4 Methodology and Innovations**

The study employs literature analysis and theoretical construction. By systematically

reviewing existing literature, relevant theories are synthesized to propose a framework for environmental design and teaching interaction. Unlike previous studies, this research focuses on the deep relationship between environmental design and teaching interaction, integrating elements such as VR and sensory stimuli to systematically analyze components of immersive learning environments.

## 2. Theoretical Analysis of Immersive Learning

### **2.1 Definition and Concept of Immersive Learning**

Immersive learning involves the use of advanced technologies to fully immerse learners in a specific environment, enhancing their learning experience and outcomes. It encompasses not only visual and auditory experiences but also tactile and olfactory participation. Mei Wenya and Li Hui (2021) suggest that the key to immersive learning is creating a realistic learning scenario through VR, thereby boosting learner engagement and effectiveness.

### 2.2 Fundamental Theories of Immersive Learning

Several theories support immersive learning. Constructivist learning theory emphasizes knowledge construction through interaction with the environment. Multisensory theory posits that engaging multiple senses can more effectively facilitate knowledge internalization and transfer. Situational cognition theory advocates for the understanding and application of knowledge within specific contexts.

### **2.3 Applications of Immersive Learning in Education**

Immersive learning has seen broad applications in education. Zhang Qi, Long Taotao, and Mei Aoxue (2024) noted VR's significant advantage in promoting learning transfer. Examples include virtual labs and historical site tours, which make learning content more intuitive and stimulate student interest and initiative. In medical education, VR-based surgical simulations effectively enhance students' practical skills and adaptability.

### 3. Theoretical Foundations of Environmental Design

## **3.1 The Relationship Between Environment** and Learning

A well-designed learning environment can significantly enhance learning outcomes. Learning environments encompass not only physical spaces but also cultural, psychological, and social dimensions. Wei Ying (2023) points out that environmental design should consider learners' physical and mental characteristics to optimize cognitive and emotional experiences.

## **3.2** Overview of Environmental Design Theory

Originating from architecture and psychology, environmental design theory includes extensive research on space utilization, color schemes, and lighting. These theories help understand the impact of environmental design on human behavior and psychological states. For instance, open learning spaces promote student interaction and collaboration, while soft lighting and appropriate colors enhance attention and comfort.

### 3.3 Environmental Cognition and Psychological Impact

Environmental design profoundly affects learners' cognition and psychology. Zhang Kai (2024) found that well-designed learning environments can significantly improve students' learning outcomes and well-being. Optimizing spatial layout and incorporating natural elements can create a vibrant learning environment, promoting holistic development.

#### 4. Design Elements of Immersive Learning Environments

## 4.1 Application of Virtual Reality Technology

Virtual Reality (VR) is a core element in designing immersive learning environments, expanding from entertainment to education. VR offers highly realistic 3D environments for various educational applications. In medicine, VR allows students to simulate complex surgeries, reducing the transition time from theory to practice and enhancing safety (Zhang et al., 2024). In history education, VR can transport students to ancient scenarios, deepening their understanding of historical events.

VR requires high-performance hardware like Head-Mounted Displays (HMDs), precise tracking systems, and compatible software platforms. Devices like Oculus Rift and HTC Vive are mainstream choices, offering highdefinition displays and responsive sensors for immersive experiences. Software engines like Unity3D and Unreal Engine support VR content development, providing essential tools and resources (Wilson, 2022).

VR significantly boosts learner engagement and hands-on skills. Wei Ying (2023) suggests VR fosters active learning by immersing students in virtual environments, making complex concepts and skills easier to grasp. VR also allows unlimited practice, overcoming the limitations of traditional "one-time experiments."

# 4.2 Role of Sensory Stimulation in Immersion

Creating an immersive learning environment involves not only VR but also sensory stimulation. Visual and auditory stimuli, via high-resolution images and stereo sound, enhance immersion. In music education, realistic audio environments help students better appreciate and understand musical elements (Wang & Li, 2021).

Tactile feedback is gaining attention, allowing students to feel the texture and weight of virtual objects, crucial in engineering and medical training. Devices like Sensable's Phantom provide haptic feedback, simulating various materials and enhancing hands-on capabilities (Chen Xiaoqing, 2024).

Multisensory stimulation enhances immersion, improving understanding and retention. It also stimulates emotions and imagination, boosting learning motivation.

## 4.3 Interactive Media and Educational Technology

Interaction is vital in immersive learning. Traditional tools like blackboards and projectors are insufficient for modern needs. Interactive media such as touch screens, electronic whiteboards, and Learning Management Systems (LMS) are increasingly used, making teaching more engaging and participative (Mei Wenya & Li Hui, 2021).

Electronic whiteboards and interactive projectors are popular, allowing flexible

content display and operation. LMS platforms, like Moodle and Blackboard, enable real-time monitoring of student progress and personalized guidance.

Interactive media not only enhance student participation but also facilitate real-time communication and interaction between teachers and students, creating a dynamic and engaging learning environment.

## 5. Optimization of Teaching Interaction Modes

#### 5.1 Basic Concepts of Teaching Interaction

Teaching interaction involves student engagement with the learning environment, including teachers, peers, and resources. It's a comprehensive exchange affecting emotions, cognition. behavior. High-quality and interaction boosts understanding, creativity, and problem-solving skills. Wei Ying (2023) identifies three interaction modes: teacherguided, student-initiated, and collaborative, each with unique advantages suitable for different contexts.

## 5.2 Synergy Between Teaching Interaction and Environmental Design

Teaching interaction and environmental design are interdependent. Effective design promotes interaction, while high-quality interaction validates design efficacy. Wei Ying and Zhang Kai (2023) found that well-designed environments, with optimal layout, lighting, and color, foster comfort and encourage student engagement.

In immersive environments, well-designed VR scenarios guide student exploration and interaction, helping solve real-world problems and enhancing learning satisfaction. Integrating interactive media further increases interaction frequency and quality.

# 5.3 Innovative Strategies for Teaching Interaction

Innovative interaction modes are crucial in modern education. Combining VR and AR creates diverse interaction scenarios. AR overlays virtual objects onto real scenes, allowing interactive learning via mobile devices.

Gamification, incorporating game design principles like task-driven goals and rewards, enhances learning motivation and engagement. For instance, a VR game in history education could involve solving puzzles and completing tasks related to historical events.

Creating thematic learning communities fosters knowledge sharing and discussion. Online forums, social media, and virtual classrooms enable continuous interaction, enhancing belonging and collaborative knowledge construction.

#### 6. Constructing the Theoretical Framework

### 6.1 Theoretical Model of Environmental Design and Immersive Learning

A multidimensional theoretical model can elucidate the relationship between environmental design and immersive learning. This model includes the physical, technical, and psychological layers of design and the cognitive, emotional, and behavioral responses of learners. It provides a comprehensive framework to analyze the impact of environmental design on immersive learning.

The physical layer involves space layout, lighting, and color. The technical layer includes VR, AR, and interactive media, creating realistic learning environments. The psychological layer addresses sensory stimulation, emotional experience, and cognitive load, enhancing motivation and effectiveness through multisensory engagement.

### 6.2 Integration of Design Elements and Teaching Interaction

The model emphasizes integrating design elements and teaching interaction. Effective design supports interaction, while diverse interaction modes validate and optimize design. Elements like spatial layout, sensory stimulation, and interactive media are analyzed quantitatively, providing theoretical and practical guidance for educational design.

### 6.3 Application and Expansion of the Theoretical Framework

The framework can be applied and refined through ongoing practice and feedback. Adapting design elements and interaction modes across disciplines and contexts identifies optimal combinations, maximizing learning outcomes. Continuous evaluation and adjustment based on learner feedback ensure dynamic optimization and improvement.

#### 7. Conclusion

This study constructs a theoretical framework for the synergy between environmental design and teaching interaction in immersive learning experiences. Covering physical, technical, and psychological layers of design and various interaction modes and strategies, the framework integrates key elements to enhance immersion and learning effectiveness.

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