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Pedagogical Patterns and Perceived Educational Value of Virtual Reality in Chinese Public Universities：A Qualitative Inquiry

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ABSTRACT

Virtual Reality (VR) is increasingly recognized as a transformative technology with the potential to enhance engagement and experiential learning in higher education (Al-Ansi et al.,2023). However, limited research has explored how educators in Chinese public universities perceive and implement VR within their specific institutional contexts (Radianti et al.,2020). This study adopts an interpretivist qualitative approach, utilizing a qualitative research design across six diverse institutions involving 15 academic professionals. Findings identify three dominant pedagogical patterns: (1) demonstration-oriented use for visual explanation; (2) experiential simulation for procedural mastery; and (3) exploratory/supplementary application for enrichment (Tan et al.,2022). Educators perceive VR's primary value in fostering sustained attention, increasing intrinsic motivation, and supporting the construction of robust mental models (Lin et al., 2024). The research concludes that the educational efficacy of VR is contingent upon intentional pedagogical alignment and robust institutional support rather than technological novelty alone (Samala, 2025).

Keywords: Virtual Reality (VR), Higher Education, Chinese Public Universities, Pedagogical Patterns, Self-Determination Theory, Qualitative Inquiry.

I. INTRODUCTION

The emergence of Virtual Reality (VR) technology represents one of the most significant technological milestones of the twenty-first century, carrying substantial implications for educational innovation and pedagogical transformation (Al-Ansi et al., 2023). Unlike conventional instructional tools often confined to two-dimensional representations, VR immerses learners in computer-generated, three-dimensional spaces where they can interact with realistic or conceptual simulations of content (Radianti et al., 2020). By enabling students to experience environments that would otherwise be inaccessible, hazardous, or prohibitively expensive—such as virtual field trips or high-stakes surgical procedures—VR serves as a promising tool for addressing longstanding pedagogical challenges in higher education (Rau et al., 2018).

In the contemporary landscape, China's higher education system offers a compelling context for investigating technological adoption. Characterized by rapid institutional expansion and a strategic national commitment to digital innovation and "smart education," Chinese public universities have integrated VR to modernize teaching effectiveness (Lin et al., 2024; Zhao et al., 2023). However, the path toward widespread and effective adoption remains uneven and contested. The mere availability of VR equipment in an institution does not automatically lead to meaningful pedagogical change (Kirkwood & Price, 2014). Instead, successful integration depends on whether educators can realistically accommodate these tools within their instructional workloads and whether they perceive the technology as pedagogically valuable rather than administratively symbolic (Bervell & Arkorful, 2020).

Despite growing global interest, significant gaps remain in the research literature. Much of the existing empirical evidence continues to prioritize student-centered outcomes or technical performance metrics, while comparatively less attention has been paid to the lived experiences and pedagogical reasoning of the educators (Samala, 2025; Tan et al., 2022). Educators occupy a central role as primary agents who determine whether VR becomes a meaningful instructional standard or remains a peripheral novelty (Kirkwood & Price, 2014). This study addresses these gaps by exploring how instructors in Chinese public universities employ VR to enhance teaching, what pedagogical affordances they perceive, and what strategies they employ to navigate institutional constraints.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Pedagogical Affordances of VR in Higher Education

The integration of VR reflects a shift toward student-centered, experiential pedagogies that prioritize active engagement and the co-construction of knowledge (Biggs, 2003). Across disciplines, VR has been shown to support deeper conceptual understanding and increased motivation when activities are aligned with clear learning objectives (Makransky & Petersen, 2019). In STEM fields, VR enables laboratory simulations that allow students to manipulate microscopic structures or repeat dangerous experiments without physical risk (Ding & Li, 2022). Similarly, in professional training contexts such as nursing and medical education, immersive simulations support procedural accuracy and situational awareness (Gavish et al., 2017).

2.2 Theoretical Framework: Self-Determination Theory (SDT)

To analyze the motivational impact of VR, this study adopts Self-Determination Theory (SDT), which posits that optimal engagement occurs when basic psychological needs—autonomy, competence, and relatedness—are satisfied (Ryan & Deci, 2020).

Autonomy is supported when learners navigate virtual environments at their own interest and pace (Ryan & Deci, 2020).

Competence is fostered through interactive simulations that provide immediate feedback, allowing students to rehearse tasks until mastery is achieved (Ryan & Deci, 2020).

Relatedness is enhanced through multi-user virtual environments that support collaborative problem-solving (Green, 2024; Lin et al., 2024).

2.3 Theoretical Framework: Cognitive Load Theory (CLT)

While SDT addresses motivation, Cognitive Load Theory (CLT) explains how instructional design interacts with human working memory (Sweller, 1988). In VR, excessive visual detail can impose Extraneous Cognitive Load, distracting learners from core objectives (Skulmowski & Xu, 2022). Effective design must prioritize Germane Cognitive Load, encouraging the mental effort devoted to schema construction and deep conceptual understanding (Sweller, 2006).

III. METHODOLOGY

3.1 Research Design and Case Selection

This study utilized a qualitative research design grounded in a multiple case study approach (Yin, 2018). This design allowed for a contextually grounded exploration of VR implementation across different institutional environments. Purposive sampling was used to select six Chinese public higher education institutions representing a spectrum of technological maturity :

Cases 1 & 2: Universities with established VR laboratories and formal institutional strategies for immersive learning.

Cases 3-6: Institutions at earlier stages of adoption, relying on pilot initiatives and individual faculty initiative.

3.2 Participants and Data Collection

The study recruited 15 academic professionals, including 9 faculty members, 4 instructional designers, and 2 technologists, all with at least one year of experience with VR integration. It should be noted that several participants took part in both the individual interviews and the focus group discussions to triangulate their individual professional reasoning with collective institutional perspectives. Data were triangulated through four primary sources :

Table 1: Participant Demographics and Institutional Context

Participant ID	Professional Role	Disciplinary Context / Unit	VR Experience (Years)	Institutional Context
P01	Faculty Member	Nursing & Healthcare	2.5	Case 1 (Established VR Lab)
P02	Faculty Member	Engineering	3	Case 1 (Established VR Lab)
P03	Educational Technologist	VR Lab Administration	4	Case 1 (Established VR Lab)
P04	Faculty Member	Engineering	3.5	Case 2 (Established VR Lab)
P05	Instructional Designer	Center for Teaching & Learning	2	Case 2 (Established VR Lab)
P06	Faculty Member	Humanities (History)	1.5	Case 3 (Pilot Initiative)

P07	Faculty Member	Humanities (Cultural Studies)	2	Case 3 (Pilot Initiative)
P08	Instructional Designer	Center for Teaching & Learning	2.5	Case 3 (Pilot Initiative)
P09	Faculty Member	Nursing & Healthcare	1.5	Case 4 (Pilot Initiative)
P10	Faculty Member	Architecture & Design	2	Case 4 (Pilot Initiative)
P11	Educational Technologist	IT Support Services	5	Case 4 (Pilot Initiative)
P12	Faculty Member	Applied Sciences	3	Case 5 (Pilot Initiative)
P13	Instructional Designer	Educational Technology Unit	1.5	Case 5 (Pilot Initiative)
P14	Faculty Member	Engineering	2	Case 6 (Pilot Initiative)
P15	Instructional Designer	Center for Teaching & Learning	2	Case 6 (Pilot Initiative)

1.Semi-Structured Interviews: Ten individual sessions (45–75 minutes) to capture pedagogical reasoning.
2.Focus Group Discussions: Three groups (4–6 participants each) to explore shared institutional challenges.
3.Document Analysis: Review of 20+ documents, including course syllabi and policy guidelines.
4.Non-Participant Observation: Direct observation in VR-enabled classrooms to understand real-time interactions.

3.3 Data Analysis

Analysis followed the thematic framework of Braun and Clarke (2006), utilizing NVivo software. Coding proceeded through three stages: open coding (identifying units like "technical anxiety"), axial coding (grouping codes into "institutional support structures"), and selective coding (refining core themes).

IV. RESULTS I: PEDAGOGICAL PATTERNS IN TEACHING PRACTICE

The analysis revealed that educators adapt VR use based on disciplinary traditions and resource constraints, resulting in three distinct patterns.

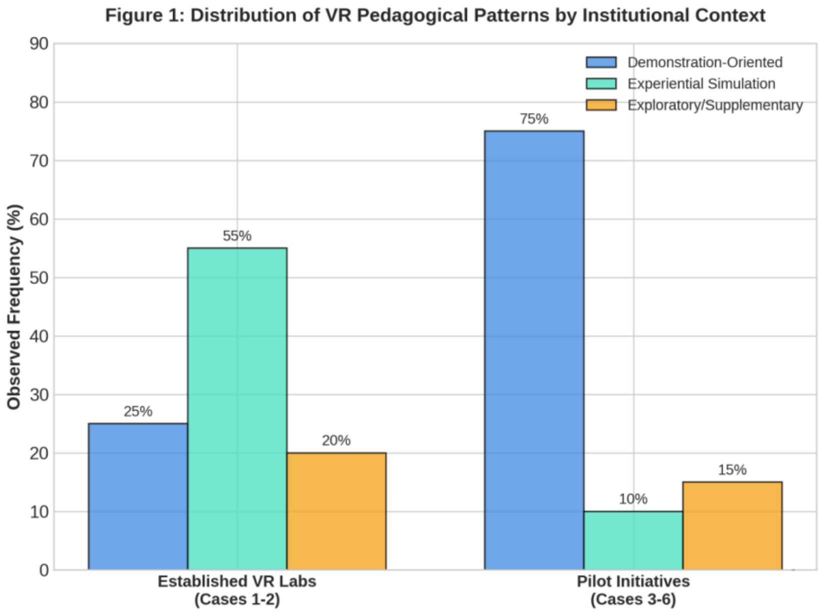

Figure 1. Distribution of VR Pedagogical Patterns across different institutional contexts. Demonstration-oriented use remains the dominant pattern in institutions at the pilot initiative stage due to resource and logistical constraints.

4.1 Pattern I: Demonstration-Oriented Use

Demonstration-oriented use emerged as the most prominent pattern (60% of cases), functioning as a visual explanatory medium in instructor-led sessions (Ding & Li, 2022). In this mode, the educator retains control over navigation while the VR view is projected onto a large screen for collective viewing.This approach is particularly pragmatic in the Chinese context, where extremely large class sizes (often exceeding 50 to 80 students) make individual headset deployment logistically unfeasible.

Engineering Example: Participant 03 described using VR to explain mechanical assemblies: "Once the VR session begins, students become immediately attentive... they can see mechanical components interact in real-time, which supports their understanding of spatial relationships".

Architecture Example: Educators utilized virtual walkthroughs to communicate scale and spatial orientation during design critiques.

4.2 Pattern II: Experiential Simulation Use

In this more immersive mode, students are active participants within simulated tasks, facilitating professional skill development (Gavish et al., 2017).

Nursing Case: VR simulated clinical scenarios where students assessed patient symptoms without real-world risk. Participant 09 emphasized the importance of this "fail-safely" environment: "Students can rehearse procedures multiple times in VR before applying them in real settings, which builds both confidence and competence".

Engineering Case: Students manipulated virtual machinery to observe system responses that would be too dangerous or expensive to test in a physical lab.

4.3 Pattern III: Exploratory and Supplementary Use

VR is also used as an optional enrichment resource, fostering independent inquiry (Biggs, 2003).

History and Heritage: Participant 06 explained that history students explore virtual reconstructions of historical cities: "VR is offered as an optional experience for students who want to explore topics in more depth".

Project-Based Learning: Participant 13 observed that when students integrated VR into their own creative projects, "they demonstrated higher levels of creativity and ownership over their work".

V. RESULTS II: PERCEIVED EDUCATIONAL VALUE

5.1 Engagement and Sustained Attention

Educators consistently reported that VR captures student attention more effectively than traditional lecture formats (Fredricks et al., 2004). Participant 03 noted that immersion keeps students "mentally present" and reduces typical classroom distractions. However, Participant 12 provided a crucial caution: "if the activity is not clearly structured, students may enjoy the experience without actually understanding the content".

5.2 Motivation and Quiet Student Transformation

A striking finding was the positive impact on passive learners (Lin, 2024). Participant 06 observed: "students who are usually quiet become more confident when they have experienced the content through VR and feel they have something concrete to contribute". This increased self-efficacy was linked to the interactive, non-evaluative nature of early VR exposure.

5.3 Construction of Mental Models

In STEM disciplines, VR supported the development of accurate mental models for abstract phenomena (Ding & Li, 2022). Participant 11 reflected that VR enables students to "see and interact with concepts rather than imagining them abstractly". This embodied cognition facilitates deeper conceptual integration.

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VI. DISCUSSION AND STRATEGIC RECOMMENDATIONS

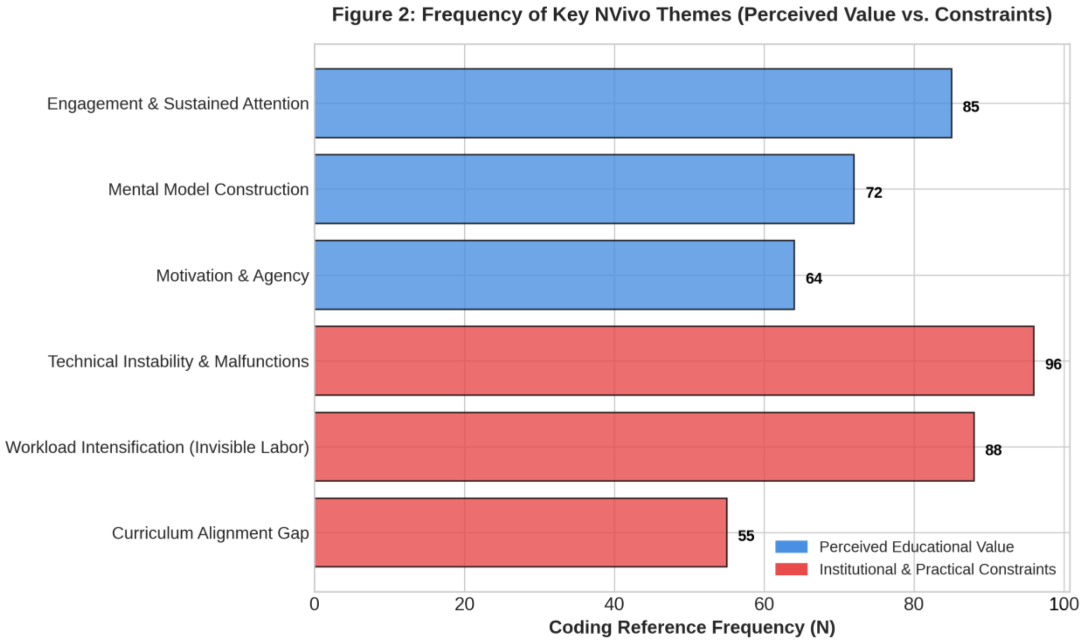

Figure 2. Frequency of key themes identified during NVivo coding. The chart juxtaposes the perceived educational benefits (e.g., Engagement, Mental Models) against the highly referenced institutional and practical constraints (e.g., Technical Instability, Workload Intensification).

6.1 The Interplay of SDT and CLT in Practice

The research confirms that successful VR integration requires balancing psychological needs with cognitive constraints (Evans et al., 2024). While Pattern II (Simulation) supports Competence, educators must manage Extraneous Load by providing structured task guides and step-by-step orientation.

6.2 Institutional Barriers in China

A significant "disconnect" was identified between institutional innovation rhetoric and material support (Lin et al., 2024; Samala, 2025).

Workload Intensification: Educators spend extensive "invisible labor" on lesson redesign and testing, which is often unacknowledged by traditional Key Performance Indicators (KPIs).

Technical Instability: Participant 10 highlighted that hardware malfunctions often discourage faculty from moving beyond pilot phases.

6.3 Strategic Recommendations

To move toward sustainable integration, participants recommended (1) Incremental Integration (phased adoption) ; (2) Communities of Inquiry for practice-sharing ; and (3) Policy Recognition of innovation in workload models (Samala, 2025).

6.4 Limitations and Future Research

Despite providing contextually rich insights into VR integration, this study has several limitations that should be acknowledged. First, the small sample size of 15 academic professionals from six specific institutions limits the statistical generalizability of the findings to the entire higher education sector in China. As a qualitative inquiry, the results represent the lived experiences and professional judgments of the participants rather than universal trends. Second, the study relies primarily on self-reported data from interviews and focus group discussions, which may be subject to individual interpretive bias or social desirability effects. Third, given the rapid evolution of VR hardware and software, the technical challenges identified may change as the technology becomes more mature and affordable. Future research should employ quantitative surveys with larger, representative samples to validate these identified pedagogical patterns. Additionally, longitudinal studies are needed to track the long-term impact of immersive pedagogies on actual student learning outcomes and academic performance across more diverse disciplines.

VII. CONCLUSION

This inquiry demonstrates that VR integration in Chinese public universities is a socially situated process mediated by educator agency and institutional infrastructure (Al-Ansi et al., 2023). While VR offers immense promise for fostering engagement and cognitive growth, its educational value is conditional upon pedagogical alignment rather than technological novelty alone (Samala, 2025). Future implementation must prioritize long-term professional development and systemic policy support to ensure that immersive learning remains a pedagogically led, inclusive standard in higher education (Lin et al., 2024; Zhao et al., 2023).

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