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From Pilot to Practice: Sustainable Management Strategies for Virtual Reality Integration in Chinese Public Universities

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ABSTRACT

While Virtual Reality (VR) is widely recognized for its pedagogical potential in higher education (Al-Ansi et al., 2023), institutionalizing immersive technologies remains a significant managerial challenge. Moving beyond instructional efficacy, this qualitative inquiry investigates the administrative and institutional barriers to sustainable VR integration in Chinese public universities (Radianti et al., 2020). Drawing on the concept of technological adaptation, this study utilizes triangulated data from 15 academic professionals across six diverse institutions. Findings identify three critical systemic bottlenecks: (1) severe resource misallocation prioritizing hardware acquisition over software development; (2) the unacknowledged "invisible labor" of educators compounded by a mismatch with traditional Key Performance Indicators (KPIs); and (3) cross-departmental silos that hinder technical support (Samala, 2025). The research concludes that transitioning from fragmented pilot projects to sustainable institutional practice requires actionable management strategies, including the redefinition of academic workload models and the establishment of cross-functional support units (Zhao et al., 2023).

Keywords: Virtual Reality (VR), Higher Education Management, Technological Adaptation, Invisible Labor, Sustainable Integration.

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). 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, as universities invest heavily in immersive laboratories, a critical managerial dilemma has emerged: the mere acquisition of VR infrastructure does not automatically lead to meaningful or sustainable pedagogical change (Kirkwood & Price, 2014). Many Chinese public universities currently find themselves trapped in a "pilot phase," where VR implementation is driven by the isolated, passion-driven efforts of early-adopter faculty rather than systematic institutional strategy (Samala, 2025). This phenomenon suggests that the primary barriers to widespread VR adoption are no longer purely technological or pedagogical, but fundamentally administrative and institutional.

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 (Tan et al., 2022). Comparatively less attention has been paid to the lived administrative experiences, resource allocation conflicts, and workload implications experienced by university staff (Radianti et al., 2020). This study addresses these gaps by shifting the analytical focus from the classroom to the administrative ecosystem. It explores how instructors navigate institutional barriers and what management strategies can facilitate robust technological adaptation.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Institutional Management of Educational Technology

The integration of VR reflects a shift toward experiential pedagogies (Biggs, 2003). However, successful integration depends on whether educators can realistically accommodate these tools within their instructional workloads (Bervell & Arkorful, 2020). Research indicates that capital-intensive hardware often becomes obsolete quickly if not supported by ongoing software licensing and centralized technical maintenance (Llanos-Ruiz et al., 2025).

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2.2 Theoretical Framework: Technological Adaptation

To analyze these institutional challenges, this study adopts the lens of Technological Adaptation. Unlike simple acceptance models, technological adaptation views integration as a continuous, dynamic process of mutual adjustment between the technology, the users, and the organizational structure. In higher education, this occurs when institutions actively modify their administrative policies, resource distribution, and evaluation metrics to accommodate VR, while faculty simultaneously adapt their workflows.

2.3 The Concept of "Invisible Labor" in Academia

A critical component of this framework is the concept of "invisible labor." In digital education, invisible labor refers to the uncompensated and unrecorded time educators spend learning new software, troubleshooting hardware, and redesigning curricula (Evans et al., 2024). When this labor is not formally recognized by institutional Key Performance Indicators (KPIs), it leads to faculty burnout and the eventual abandonment of the technology.

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). Purposive sampling was used to select six Chinese public higher education institutions representing a spectrum of technological maturity: Cases 1 & 2 possess established VR laboratories, while Cases 3-6 rely on pilot initiatives.

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. Data were triangulated through four primary sources:

Semi-Structured Interviews: Ten individual sessions (45–75 minutes).

Focus Group Discussions: Three groups (4–6 participants each).

Document Analysis: Review of institutional policy guidelines and workload metrics.

Non-Participant Observation: Direct observation in VR-enabled classrooms.

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 "budget constraints"), axial coding (grouping codes into "managerial barriers"), and selective coding (refining core themes).

IV. RESULTS I: SYSTEMIC BARRIERS TO VR INTEGRATION

The thematic analysis revealed three primary administrative and institutional bottlenecks that impede sustainable VR integration.

4.1 Resource Misallocation: The "Hardware-First" Fallacy

A dominant theme across the interviews was the strategic misalignment of institutional funding. Administrations heavily prioritize the visible procurement of expensive VR headsets to enhance institutional prestige, leaving severe funding deficits for software acquisition and faculty training. Participant 03 (Educational Technologist) noted: "The university spent millions on top-tier headsets to showcase during campus tours, but zero budget was allocated for purchasing the specialized simulation software needed for actual teaching. The hardware sits idle."

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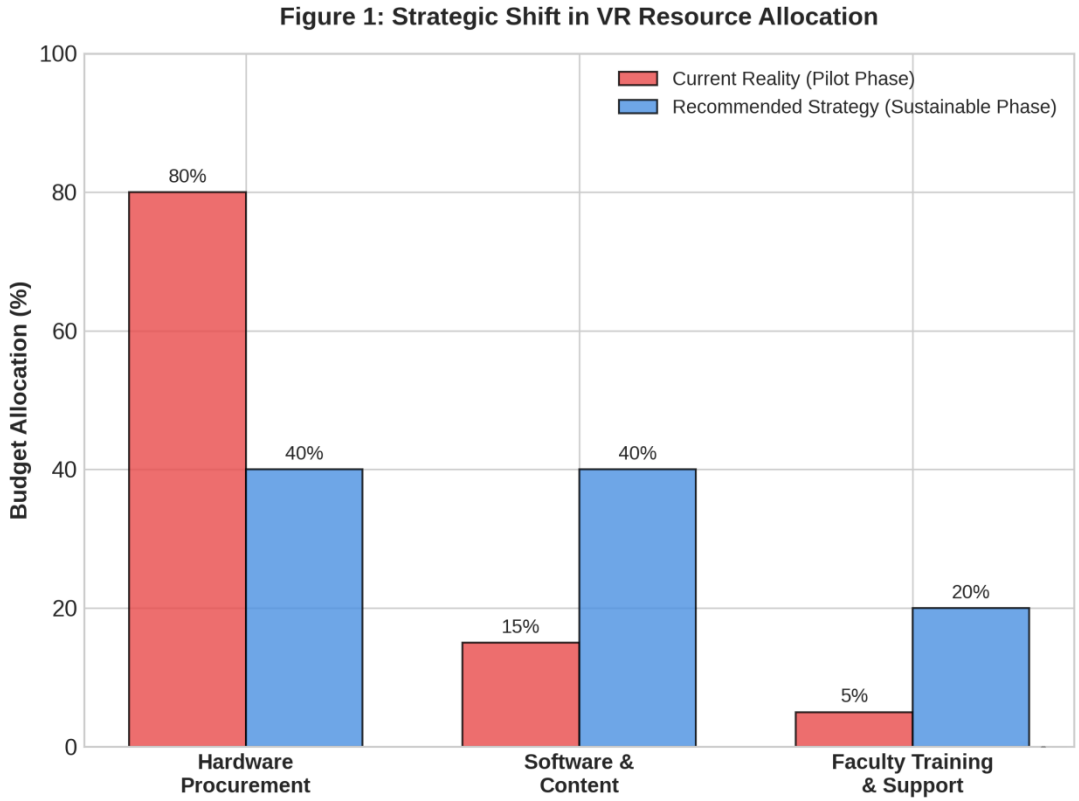

Figure 1. Strategic shift in VR resource allocation. The chart illustrates the heavy institutional bias towards hardware procurement during the pilot phase (current reality) and contrasts it with the recommended balanced investment model necessary for sustainable integration.

4.2 Invisible Labor and KPI Mismatch

The adaptation of traditional curricula into immersive VR formats requires an extraordinary investment of time. However, this "invisible labor" is entirely unrecognized by existing institutional KPIs. Participant 10 (Faculty Member) highlighted this conflict: "Developing a single VR module takes me four times as long as preparing a traditional lecture. Yet, my annual performance review only counts standard teaching hours and research publications. Innovation actually penalizes my career progression."

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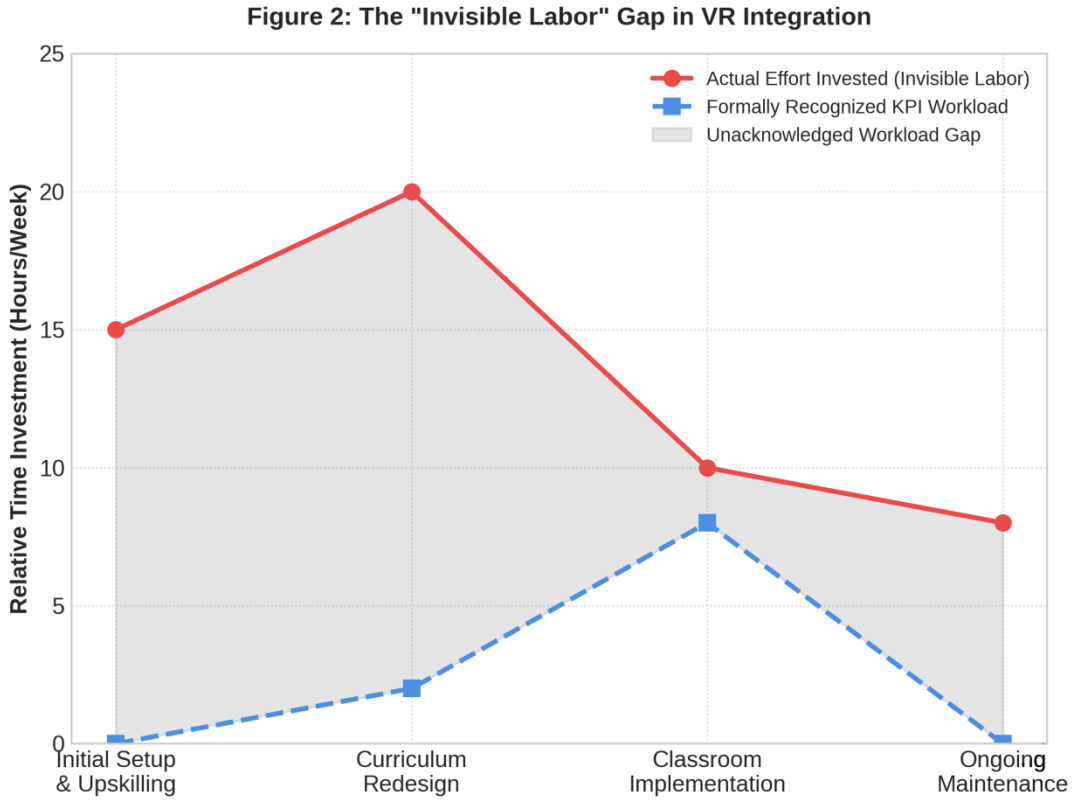

Figure 2. The "invisible labor" gap in VR integration. The shaded area represents the unacknowledged cognitive and temporal effort educators invest across different phases of implementation, which remains largely unrecognized by traditional academic Key Performance Indicators (KPIs).

4.3 Cross-Departmental Silos and Technical Deficits

Sustainable VR integration requires seamless collaboration. However, data revealed deep organizational silos between academic departments and IT support services. Participant 11 (IT Support) explained: "Our IT department is structured to maintain Wi-Fi and basic projectors, not to troubleshoot complex VR rendering issues mid-lecture. There is no dedicated protocol for immersive technology support."

V. RESULTS II: FACILITATORS FOR SUSTAINABLE ADOPTION

Despite systemic barriers, participants identified grassroots strategies that currently sustain VR initiatives.

5.1 Grassroots Communities of Practice

To overcome the lack of formal training, early adopters formed informal peer-support networks. Participant 05 (Instructional Designer) observed: "Because there is no centralized training, faculty members who successfully use VR often host informal workshops for their colleagues over the weekend. This peer-to-peer mentoring is the only thing keeping the initiative alive in our faculty."

5.2 Student Feedback as a Managerial Catalyst

Positive student feedback emerged as a powerful tool for faculty to negotiate for better resources. When administrators observe tangible increases in student engagement, they are more likely to approve subsequent software budgets.

VI. DISCUSSION AND STRATEGIC RECOMMENDATIONS

6.1 Redefining Academic Workload Models

To mitigate the impact of unacknowledged labor, university administrators must reform workload calculation metrics (Evans et al., 2024). Time spent on VR curriculum design, testing, and technical upskilling should be formally quantified and credited towards faculty teaching loads or professional development KPIs.

6.2 Establishing Cross-Functional Immersive Support Units

To dismantle departmental silos, universities should establish dedicated, cross-functional support teams.

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These units should integrate instructional designers with specialized IT staff to provide comprehensive, "one-stop" assistance to faculty.

6.3 Phased Funding for Capacity Building

Institutions must abandon the "hardware-first" fallacy. Strategic planning should mandate a phased funding model where capital expenditure on hardware is strictly matched by ongoing operational expenditure for software licenses and continuous pedagogical training (Samala, 2025).

6.4 Limitations and Future Research

This study has several limitations. First, the small sample size of 15 academic professionals limits the statistical generalizability of the findings. Second, the study relies primarily on self-reported data from interviews, which may be subject to individual interpretive bias. Given the rapid evolution of VR hardware, the management challenges identified may change. Future research should employ quantitative surveys with larger samples to validate these identified institutional barriers across more diverse educational management contexts.

VII. CONCLUSION

The widespread integration of Virtual Reality in Chinese public universities cannot be achieved through equipment procurement alone. This inquiry demonstrates that the true barriers to immersive learning are deeply rooted in institutional management, specifically regarding resource allocation, workload recognition, and departmental coordination. By embracing the principles of technological adaptation, higher education administrators can dismantle these systemic barriers. Implementing revised KPI models and establishing cross-functional support units will ensure that VR evolves from a fragile pilot project into a resilient, sustainable, and pedagogically transformative institutional standard.

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