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Research on the Application of "VR + Theory-Practice Integrated Teaching Method" in Practical Training Teaching in Secondary Vocational Education

HUANG Ying
Guizhou Normal University, Guiyang, China
CHEN Mei-Fen
Shenzhen Polytechnic University, Shenzhen, China

To address the prevalent issues in secondary vocational education practical training courses—insufficient student engagement, lack of intrinsic motivation, and outdated pedagogical approaches—this study proposes an innovative instructional design framework integrating Virtual Reality technology with theoretical-practical integration pedagogy. The developed "VR-enabled Theory-Practice Integrated Instructional Model" strategically structures the practical training process into three distinct phases: pre-class theoretical preparation, in-class implementation combining virtual simulation experiments with hands-on practical operations, and post-class consolidation through systematic review. Through rigorous comparative experimentation, this research empirically demonstrates the superior efficacy of the VR-integrated theoretical-practical pedagogy over conventional instructional methods in enhancing learning outcomes.

Keywords: VR-enhanced theory-practice integrated, practical pedagogy

Introduction

The implementation of the "Made in China 2025" national strategy positions intelligent manufacturing as a critical development direction, demanding a new generation of high-skilled talents to support its innovative growth. This shift has altered the structural demand for technical personnel, emphasizing the need for frontline technical experts proficient in advanced manufacturing. Secondary vocational colleges, serving as incubators for applied high-skilled talents, are tasked with cultivating professionals to meet the demands of intelligent manufacturing. However, practical training teaching faces challenges such as insufficient equipment and limited training venues, leading to overreliance on lecture-based or demonstration-oriented methods. Students often lack hands-on practice opportunities, hindering the intensity of practical skill development.

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HUANG Ying, College of Physical and Electronic Sciences, Guizhou Normal University, Guiyang, China.
CHEN Mei-Fen (corresponding author), Ph.D., Associate Professor, College of Digital Creativity and Animation, Shenzhen Polytechnic University, Shenzhen, Guangdong, China.

Virtual Reality (VR) technology addresses these limitations by simulating complex real-world scenarios and components in a three-dimensional, highly immersive environment. Through wearable devices, students can interact with virtual environments using headsets and controllers, enhancing engagement. VR enables exploration, modification of training processes, and multisensory interactions (visual, auditory, tactile), fostering collaborative problem-solving skills. Integrating VR into practical training mitigates the disconnection between theoretical and practical instruction. However, the effectiveness of VR in education hinges on its alignment with pedagogical principles, appropriate instructional design, and evaluation metrics. The key lies in resolving high-risk or inaccessible training scenarios while ensuring seamless integration of theory and practice.

The theory-practice integrated teaching method has been widely adopted to bridge the gap between knowledge acquisition and skill application in practical training. This study proposes a “VR + theory-practice integrated teaching method” framework to address existing challenges in secondary vocational practical training, aiming to optimize teaching outcomes.

Issues in Secondary Vocational Practical Training Teaching

Insufficient Student Engagement

Secondary vocational students often exhibit weak foundational knowledge and inadequate self-directed learning habits. Most fail to preview course materials, plan study schedules, or keep pace with classroom instruction, resulting in cumulative knowledge gaps. When encountering difficulties, students tend to disengage rather than explore solutions. To address this, educators must guide pre-class preparation, design interactive in-class activities, and reinforce post-class consolidation. Diversified learning methods, such as group collaboration and inquiry-based tasks, can enhance engagement and critical thinking.

Lack of Intrinsic Learning Motivation

Many students lack clear career goals or professional identity, leading to passive participation in practical training. Overemphasis on theoretical knowledge and limited hands-on opportunities diminish enthusiasm. Weak problem-solving autonomy and underutilization of online learning resources further hinder progress. Significant disparities in learning styles and foundational knowledge among students exacerbate these challenges, with some struggling to grasp practical content and losing confidence. Cultivating interest and fostering proactive learning attitudes are essential.

Outdated Teaching Methods

Despite the emergence of “Internet + Education” innovations (e.g., MOOCs, micro-videos, virtual labs), practical training remains constrained by traditional approaches due to limited facilities. Mechanical memorization dominates classroom practices, neglecting student-centered learning experiences and hindering knowledge internalization. Post-class review relies heavily on static materials (textbooks, notes), failing to replicate authentic practical environments. This inadequacy stifles innovation, scientific inquiry, and timely skill reinforcement.

Design of the “VR + Theory-Practice Integrated Teaching Method” Instructional Framework

Pre-Class Theoretical Learning Phase

Learning task sheets. Learning task sheets are employed to clarify learning objectives, content, assessment criteria, and feedback mechanisms. These sheets analyze students’ prior knowledge and present learning goals in an accessible format, embedding content within contextualized and meaningful tasks. Task design follows a progressive structure—from simple to complex—to bridge instructional phases, address key challenges, and cultivate autonomous exploration skills (Bu, 2018).

Resource distribution. Teachers provide curated resources to support foundational knowledge acquisition. However, redundant or low-quality materials (e.g., repetitive explanations, poor audiovisual production, disconnected content) may hinder learning efficiency. To motivate self-directed learning, instructors can introduce cognitive conflicts between "resource-resource" or "cognitive structure-resource" to stimulate intentional engagement. Techniques such as experiments, critical reading, and error analysis encourage active, meaningful learning (Liu, 2015).

Diagnostic assessments. Pre-class diagnostic assessments evaluate students' baseline knowledge and promote accountability. Automated scoring via online platforms provides immediate feedback, enabling instructors to tailor subsequent tasks and enhance participation. These assessments objectively measure pre-learning outcomes, informing instructional adjustments (Liu, Yu, Hou, & Wang, 2021).

Interactive Q&A. Structured discussions foster collaborative knowledge construction. Teachers or peer facilitators guide debates while balancing feedback to avoid stifling independent thought. Online forums encourage critical thinking, with studies showing richer interactions and higher-order reasoning when instructors act as facilitators rather than authorities (Liu et al., 2021).

In-Class Virtual Experimentation + Practical Operation Phase

Knowledge integration + lesson introduction. Summarize pre-class theoretical concepts and address common misconceptions. Introduce new content through micro-videos or real-world problem scenarios. VR-enhanced contexts improve abstract concept comprehension by merging theory with immersive, interactive environments.

Collaborative learning groups. Groups are structured heterogeneously (diverse skills within groups, comparable ability across groups) to maximize peer learning. Collaboration extends beyond classmates to include industry professionals and online communities. Teachers train students in conflict resolution and task delegation to optimize group productivity (Jin, 2005).

Virtual simulation training. Guided by instructor demonstrations, students explore equipment structures, workflows, and operational standards in VR environments. Multisensory simulations (audio, animation, 3D modeling) transform static textbook content into dynamic, accessible experiences, bridging theoretical and practical gaps (Yang et al., 2022).

Formative evaluation of virtual experiments. Platform analytics track video completion, discussion participation, and assignment submissions. Multi-source evaluations (self-assessment, peer review, instructor feedback) identify knowledge gaps. Instructors guide groups to troubleshoot issues iteratively.

Practice project task assignment. Tasks are decomposed into incremental objectives aligned with industry standards (e.g., new energy vehicles maintenance protocols). Real-world problem scenarios anchor learning, enabling students to assimilate new knowledge through prior experience (Lin, 2020).

Maintenance plan development. Students consult manuals to diagnose faults, formulate repair strategies, and draft standardized maintenance plans. Differentiated tasks accommodate skill levels, ensuring achievable challenges. Peer discussions refine solutions before practical implementation (Bai, Wang, Zheng, Chen, Huang, & Fu, 2023).

Skill demonstration. Instructors model standardized procedures from manuals, emphasizing safety and precision. Students replicate operations under supervision, internalizing best practices.

Hands-on vehicle maintenance. Enterprise supervisors oversee onsite tasks (e.g., power battery disassembly). Students apply task sheets, manuals, and notes to execute operations collaboratively, simulating workplace conditions (Bai et al., 2023).

Formative evaluation of practical skills. Multi-stakeholder evaluations (self, peers, teachers, industry mentors) assess task outcomes. Discrepancies between results and goals trigger plan revisions, revisiting earlier stages for data reanalysis.

Post-Class Consolidation Phase

Review tasks. Post-class assignments reinforce knowledge via virtual simulations, quizzes, and optimization exercises. Blended online-offline activities strengthen theory-practice integration.

Resource reinforcement. Platforms like Chaoxing (超星) distribute simulation software for independent practice. Students systematize knowledge, address gaps, and propose technical innovations.

Comprehensive evaluation & reflection. Instructors analyze learning reports, project outcomes, and forum interactions to gauge mastery. Post-task discussions identify weaknesses in virtual/practical phases, guiding iterative improvements.

Conclusion

Comparative experiments were used to demonstrate that the “VR + integrated theory and practice teaching method” is superior to traditional teaching methods. The “VR + Theory-Practice Integration” framework addresses chronic issues in vocational education—low engagement, outdated pedagogy, and disconnects between theory and practice. Key advantages include:

(1) Cost-effective resource sharing: VR eliminates reliance on expensive physical equipment, democratizing access to high-risk/high-cost training.

(2) Immersive skill development: Safe, interactive environments enhance motivation and deepen conceptual understanding.

(3) Diversified assessment: VR platforms enable granular tracking of learning trajectories, supporting personalized feedback.

This approach redefines vocational training by merging technological innovation with pedagogical rigor, offering scalable solutions for cultivating industry-ready talent.

References

Bai, Y., Wang, G., Zheng, Y., Chen, M., Huang, Y. C., & Fu, X. F. (2023). A “triple-integration, nine-step” practical teaching model for automotive maintenance. *Laboratory Research and Exploration, 42*(9), 224-228+292.

Bu, C. (2018). Research on flipped classroom theory and practice from the perspective of deep learning (Ph.D. thesis, Shaanxi Normal University, 2018).

Jin, Y. (2005). *Cooperative learning*. Chengdu: Sichuan Education Press.

Lin, Z. (2020). Development of teaching resources for new energy vehicle electrotechnics (M.Sc. thesis, Tianjin Vocational and Technical Normal University, 2020).

Liu, C., Yu, P., Hou, J., & Wang, Y. (2021). How online discussion modes influence learners’ critical thinking. *Journal of Educational Technology Research, 42*(3), 48-54+61.

Liu, S. (2015). Instructional design for pre-class learning in flipped teaching. *Vocational and Technical Education, 36*(11), 29-32.

Yang, Q., Zhu, L., Zhang, X., et al. (2022). Teaching competitions as catalysts for vocational education reform. *Journal of Educational Technology Research, 43*(3), 85-90+104.