

Teaching Reform of the Course *Application of Virtual Reality* Driven by the Dual Forces of Industry-Education Integration and AI Empowerment

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Abstract: Aiming at the teaching dilemmas of the course *Application of Virtual Reality* for design-oriented majors, this study takes the course *Application of Virtual Reality* as the research object and proposes a dual-driven reform mode combining industry-education integration and AI empowerment. It constructs a teaching-operation mechanism of the “industry-education integration-AI-empowerment double-helix structure”, in which the two chains — the industry-education-integration chain (industrial demand-educational supply-evaluation feedback) and the AI-empowerment chain (technical assistance-intelligent learning companionship-learning diagnosis) are coupled layer by layer to form a closed loop from competence generation to industry re-engagement. Teaching practice shows that the teaching reform under this mode relieves students’ programming anxiety, improves their creativity-conversion rate and market adaptability of their works, and provides referenceable solutions for the teaching reform of interdisciplinary integration-oriented courses.

Keywords: Industry-education integration; AI empowerment; Teaching reform; Virtual reality course

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1. Introduction

In September 2022, *Catalogue of Disciplines and Majors for Postgraduate Education (2022 Edition)* was released. Design science became a first-level discipline under the category of interdisciplinary studies (Code:1403), which can confer academic degrees in engineering and art ^[1]. The order of art and engineering was swapped in the disciplinary guideline statement, highlighting to a certain extent the disciplinary orientation of “engineering priority” ^[2]. This disciplinary orientation poses new challenges to traditional design education centered on artistic literacy. It requires students to possess comprehensive capabilities, including interdisciplinary knowledge integration, application of technical tools, and innovative solutions to complex

problems. Industry-education integration serves as an important approach to respond to the above-mentioned proposition. Its core value lies in breaking down barriers between the education chain and the industrial chain, fundamentally resolving the pain point of “content lagging behind industry”, and providing institutional guarantees for talent cultivation in interdisciplinary design science^[3]. The development of artificial intelligence (AI) technology provides new empowering tools for curriculum reform of design-oriented majors. In 2025, the *Outline for Building a Powerful Country Through Education (2024-2035)* listed “artificial-intelligence-driven educational transformation” as a key task. The application of AI in key links such as programming assistance, Q&A and error correction, and effect preview can lower the technical threshold for non-computer-major students^[4].

Existing studies are mainly carried out from the following two aspects. (1) Teaching reform of industry-education integration. Ge Jing put forward the idea of three-chain synergy, providing a systematic theoretical framework for industry-education integration^[5]. Liu Zeyu further extended it to art-design major groups and proposed the “three-innovation and five-chain” teaching mode, focusing on the connection between the education chain and the industrial chain^[6]. Guan Shixiang et al. put forward a collaborative-education system and teacher-team-construction mechanism for art-design disciplines^[7]. (2) AI-empowered teaching. Taking the course of industrial economics as an example, Guo Zhengquan et al. embedded AI into every teaching link and proposed the “five-in-one” industry-education-integration mode^[8]. Zhu Yichun et al. verified the effectiveness of AI empowerment plus industry-education integration from the perspective of engineering courses^[9]. The above-mentioned studies either focus on engineering majors or emphasize a single dimension. Research on the dual-driven reform of “industry-education integration + AI empowerment” for interdisciplinary integration-oriented courses is still relatively insufficient, lacking theoretical construction of their collaborative mechanisms.

2. Current situation of the course *Application of Virtual Reality*

With the wide application of virtual reality (VR) technology in entertainment, education, medical treatment, industry and other fields, market demand for talents engaged in VR-content development keeps growing. “Virtual Reality +” has become a development trend, strongly spawning an emerging technology industry^[10]. VR courses for design-oriented majors are offered under an interdisciplinary background, featuring distinct characteristics such as “interdisciplinary integration, rapid technological iteration, and strong application orientation”. Current course teaching faces three practical problems:

- (1) Disconnection between course contents and industrial frontiers. Virtual reality is marked by prominent features of interdisciplinary integration, close application relevance, and rapid development and update speed^[11], setting high requirements for synchronous updating of course contents and industrial frontiers. In fact, however, course objectives of *Application of Virtual Reality* are mostly independently set by on-campus teachers, leading to a large gap between what students learn and enterprise demands. This structural mismatch between “industrial demand” and “educational supply” creates a structural gap at the source of the industry-education-integration chain.
- (2) Single course-teaching methods. Traditional VR teaching mostly relies on preset programs to realize fixed operation steps. It cannot provide personalized guidance according to students’ real-time operational behaviors, and it is difficult to achieve targeted improvement of teaching effects^[12]. Most students of design-oriented majors come from art-related backgrounds and generally have weak programming

foundations. Coupled with homogenized and monotonous teaching methods, students can hardly systematically improve their capabilities of solving complex design problems with VR technologies through course learning, which directly restricts actual teaching outcomes.

- (3) Superficial school-enterprise cooperation and one-dimensional evaluation. In practice, industry-education integration still encounters dilemmas of formalism and superficiality: enterprise experts are embedded in classroom teaching as lecturers yet can hardly be fully integrated into students' daily learning. Teaching evaluation lacks systematic investigation into value-oriented dimensions such as students' professional identity, sense of responsibility and ethical norms. As a result, cultivation outcomes can hardly meet enterprise requirements. According to surveys conducted by Zhu Huijuan et al., after graduation, VR-major students often still need to spend about six months of training to make them competent for real-world posts^[13]. Loose school-enterprise cooperation and one-dimensional evaluation bring about a structural gap between student-cultivation quality and enterprise employment standards.

3. Teaching-reform design for the course *Application of Virtual Reality*

Targeting the three practical existing problems of the course, this teaching reform carries out systematic design under the dual-driven mode, constructs the teaching-operation mechanism of the “industry-education integration-AI-empowerment double-helix structure”, and forms a closed loop of “competence generation — industry re-engagement”. Real-world enterprise projects are effectively transformed into teaching resources; AI-powered intelligent learning companionship is adopted to enrich teaching means, improve students' creativity-conversion rate and market adaptability of their works, and guide the shift of teaching from knowledge imparting to literacy cultivation.

3.1. Teaching-reform objectives

This course reform mainly achieves three-fold objectives: (1) Realize synchronous updating of teaching contents and industrial frontiers; realize in-depth docking between teaching and industrial demands through the collaboration of school-enterprise dual subjects. (2) Enable AI empowerment on demand in key links to significantly improve students' capabilities of solving complex design problems. (3) Implement the dual-tutor system for schools and enterprises as well as the multi-dimensional evaluation mechanism, so that evaluation feedback can truly reflect student-cultivation quality and enterprise employment requirements.

3.2. Teaching-reform framework

Existing studies mostly carry out curriculum reform from the single dimension of either industry-education integration or AI empowerment, lacking systematic construction of their collaborative mechanisms. From the perspective of art education, Tian Chuanliu et al. systematically constructed a mechanism model of AIGC empowerment^[14], which provides a methodological reference for this course. In accordance with the three-fold dilemmas of the course and teaching-reform objectives, this teaching reform puts forward the “industry-education integration-AI-empowerment double-helix structure” as the framework for this course reform (see **Figure 1**).

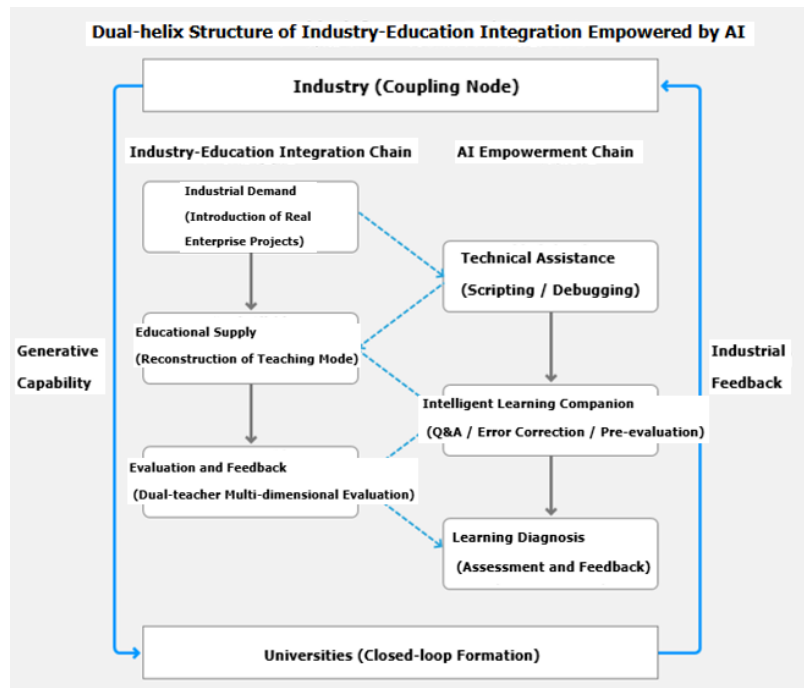


Figure 1. Teaching-Operation Mechanism Diagram of the “Industry-Education Integration-AI-Empowerment Double-Helix Structure.”

- (1) Complementarity between industry-education integration and AI empowerment. Industry-education integration addresses the problem of industrial disconnection by taking real-world enterprise projects as the entry point; AI empowerment solves the problem of monotonous teaching methods by adopting multiple auxiliary teaching means. They function at the objective level and the methodological level of teaching, respectively. Nevertheless, these two levels are not isolated. Neither of the two dimensions can solve all problems independently, and mutual collaboration and joint construction of the two levels are required.
- (2) Coupling property between industry-education integration and AI empowerment. The industry-education-integration chain acts on the source and output of teaching content, while the AI-empowerment chain acts on the assistance and diagnosis of teaching processes. The two chains are coupled at two nodes: industry at the top and universities at the bottom, correspondingly forming a spiral structure of “industrial demand → technical assistance”, “educational supply → intelligent learning companionship”, and “evaluation feedback → learning diagnosis”, advancing layer by layer.
- (3) Closed-loop feature of the double-helix structure. Industrial demands at the top go through layer-by-layer coupling and progression of the two chains, and finally converge into universities at the bottom to form student competencies. After students enter enterprises, industry re-engagement is generated and returns to the demand side at the top, completing the closed loop of “industrial demand → dual-chain function → competence generation → feedback to industry”. It provides a feasible scheme for the implementation of teaching reform.

3.3. Teaching-reform paths

Based on the above-mentioned double-helix structure, this course puts forward three corresponding reform

paths targeting the three specific problems mentioned in Chapter II:

- (1) Joint construction by schools and enterprises to restructure teaching objectives and teaching contents. This course carries out in-depth cooperation with Shanghai Sanmei Information Technology Co., Ltd. to jointly formulate teaching objectives and course syllabi. On-campus teachers, in accordance with course positioning and learning characteristics of art-major students, define teaching outcomes jointly with enterprises. Enterprises deeply integrate excellent project cases into teaching practice, allowing students to get access to typical industrial cases. Course contents are updated regularly according to industrial development and technological progress to ensure synchronization with industrial frontiers. Course contents are organized progressively in four modules: “theoretical cognition — basic operations — practical cases — project development” to realize progressive competence improvement^[15].
- (2) AI-powered intelligent learning companionship embedded into key teaching links on demand. This course does not pursue full-process coverage of AI; instead, it focuses on key links that pose the greatest difficulties for design-major students, such as script writing & error correction, Q&A, and pre-evaluation, and introduces AI-based intelligent learning companionship on demand. With AI assistance, students are freed from tasks with high cognitive load and can devote more energy to creative conception and work implementation. In the script-writing session, students describe design intentions in natural language, and AI generates basic C# code to lower programming-related learning thresholds. In this way, inspiration will no longer be restricted by poor programming capabilities. In the Q&A session, instant answers are provided when students encounter puzzles. Teachers are freed from tedious Q&A work and can better guide work from a holistic perspective. In the pre-evaluation session, AI conducts a pre-evaluation self-check before work submission. Students make revisions according to modification suggestions to improve learning efficiency and work quality. Meanwhile, learning-diagnosis reports are generated to provide a basis for teachers to adjust teaching strategies.
- (3) Collaboration of dual tutors to implement four-dimensional evaluation. This course implements the dual-tutor system: on-campus tutors are responsible for teaching design methodologies, academic norms, and basic theories; enterprise tutors take charge of practical-project guidance, tackling technical difficulties, and introducing industrial norms. Enterprises realize whole-process intervention through participating in curriculum design, project review and graduation-thesis-topic selection. The evaluation mechanism adopts the multi-evaluation approach of “teachers + students + enterprises + works”. It assesses not only technical performance but also professional attitudes and sense of responsibility, so that evaluation feedback can truly reflect student-cultivation quality and enterprise employment requirements.

4. Implementation and practice of teaching reform

Based on the operating mechanism of the “industry-education integration-AI-empowerment double-helix structure”, this chapter elaborates on the specific implementation process, preliminary practical outcomes, and continuous feedback-improvement mechanism of the course reform of *Application of Virtual Reality* from a practical perspective, and systematically presents the implementation of the reform scheme in real-world teaching scenarios.

4.1. Implementation of teaching reform

Combining the online-course platform and four-modular teaching contents, this course promotes teaching

reform in four stages: “investigation — design — pilot implementation — popularization”.

- (1) Stage One: Demand investigation. Contact and visit enterprises engaged in virtual-reality-related technologies, sign school-enterprise cooperation agreements, and clarify enterprise employment demands and directions for curriculum reform.
- (2) Stage Two: Curriculum design. Based on enterprise demands and learning situations of art-major students, this course simultaneously promotes the construction of online-course platforms and the reconstruction of four-modular teaching contents. In terms of online courses, the online course *Application of Virtual Reality* is built on the Superstar Learning-Platform, covering modules such as teaching videos, case libraries and interactive Q&A to support students’ blended online-and-offline learning. In terms of teaching content, it is reconstructed into four progressive modules in accordance with backward-design principles (see **Table 1**). The four modules follow the competence-progression rule of “from easy to difficult, from learning to doing”.

Table 1. Teaching Modules of the Course *Application of Virtual Reality*

Module Name	Corresponding Teaching Objectives	Teaching Contents	Dual-Driven Features
Module 1: Theoretical Cognition (4 class hours)	Understand the overall picture and development trends of the VR industry and build a knowledge framework.	Basic VR principles, industrial development, technological frontiers	Industry-Education Integration (introduction of enterprise cases)
Module 2: Basic Operations (4 class hours, excluding online hours)	Master basic software operations via online courses	Scene construction, environmental-parameter setting, particle special effects, animation production, etc.	Industry-Education Integration (enterprise technical standards) + AI Empowerment (assisted basic operations)
Module 3: Project Practice (16 class hours)	Complete VR project development with AI assistance and improve capabilities for solving complex problems	VR user-interface design, interaction and game production	Industry-Education Integration (real-world enterprise projects) + AI Empowerment (intelligent learning companionship)
Module 4: Enterprise Practical Training (8 class hours)	Be familiar with delivery procedures of real-world enterprise projects and improve post-graduation adaptability	Real-world project delivery and guidance from enterprise tutors	Industry-Education Integration (whole-process enterprise intervention)

- (3) Stage Three: Pilot teaching. Select the Digital-Media-Art major as the pilot object, with 40 students participating in the first-round teaching practice. The pilot focuses on verifying the rationality of the four-module design, the feasibility of AI-based intelligent learning companionship, and the degree of coordination in school-enterprise dual-tutor collaboration. Results show that students have good acceptance and teaching objectives are basically achieved, laying a foundation for subsequent popularization across the whole college.
- (4) Stage Four: College-wide popularization. As a college-wide elective course for the School of Design, this course is open to multiple design-oriented majors including environmental design, product design, visual communication and digital media art. The four modules are flexibly adjusted according to the learning situations of different majors. For instance, add a spatial-narrative module for environmental-design majors and an interactive-device module for product-design majors. In terms of enterprise cooperation, a VR-work library is jointly built with enterprises to realize the transformation of excellent works into real products and feed subsequent teaching.

4.2. Practical outcomes

Preliminary outcomes have been achieved through teaching reform. In terms of works: more than 30 VR works have been completed in this round of teaching reform, covering scenarios such as cultural-tourism exhibition, interactive exhibition, education and training. For example, the work *Wuzhou Kiln Virtual Exhibition Hall* developed by student teams comprehensively adopts 3D scanning, AI-assisted scripting and interactive design to present the traditional firing-craft techniques of Wuzhou Kiln immersively. Eight works have been selected by enterprises as works with product-transformation value and included as teaching cases for the next grade. In terms of teaching feedback, questionnaires and scales are adopted to assess students' programming anxiety. The anxiety score dropped from 3.42 (SD = 0.65) to 2.18 (SD = 0.53), with statistically significant differences ($t = 8.73, p < .001$, Cohen's $d = 1.21$). Student reflection journals are collected for feedback, with representative comments such as "AI helps me get past programming obstacles, and I can focus on creativity" and "VR development is not as far-fetched as I thought". Enterprise tutors commented that "the completion level of student works exceeds expectations, and some of them already possess commercialization potential".

5. Conclusion

Centering on the core concept of dual-driven industry-education integration and AI empowerment, this study constructs a systematic reform scheme for the course *Application of Virtual Reality*. Targeting three practical problems, including backward course contents, monotonous teaching methods, and superficial school-enterprise cooperation, it puts forward the double-helix structure and three corresponding reform paths, and preliminarily verifies its feasibility through teaching practice. This study can provide scheme references for teaching reform of similar interdisciplinary integration-oriented courses. This research still has the following limitations: first, this study is still in the preliminary-exploration stage, and its long-term effects require further verification. Future research can be continuously promoted from three aspects: extending the tracking cycle, expanding interdisciplinary pilot projects, and deepening multi-dimensional evaluation reform.

Disclosure statement

The author declares no conflict of interest.

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