Journal of Contemporary Educational Research, 2026, Volume 10, Issue 3
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

Teaching Design and Practical Exploration of Ideological and Political Education in Industry-Education Integration Courses Based on the OBE Concept

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Abstract: Against the backdrop of the New Liberal Arts, and in response to challenges such as the disconnect between professional education and value guidance, as well as the separation between the classroom and the market, this paper explores the reform of Ideological and Political Education within courses featuring industry-education integration, guided by the Outcome-Based Education (OBE) concept. The curriculum is driven by the dual core of "industry-education integration + innovation and entrepreneurship," constructing a three-dimensional objective system encompassing "technological innovation capability, business insight, and value-led leadership." Through a three-tiered progressive practice of "project-based learning, competition-based learning, and entrepreneurship-based learning," the course content is deconstructed into four modules—"Dao (Principles), Fa (Methods), Shu (Techniques), and Qi (Tools)"—which integrate ideological and political themes such as traditional culture and social needs, achieving a two-way empowerment of technology and ethics. The teaching adopts a dual-tutor system featuring a "student-centered, teacher-guided" approach and establishes a tripartite collaborative evaluation mechanism. This forms a closed loop of "theory-practice-real-world positions," breaking down the barriers between the classroom and the market, thereby providing a replicable pathway for cultivating high-quality, innovative talents.

Keywords: OBE concept; Integration between industry and education; Ideological and political education in courses

Online publication: April 9, 2026

1. Introduction

In the context of deeply implementing the strategies of innovation-driven development and self-reliance in science and technology, the deep integration of emerging technologies such as artificial intelligence and the Internet of Things with physical products is not only driving industrial transformation but also introducing new ethical challenges related to data privacy and algorithmic fairness. Conversely, current education in industrial

design faces three structural contradictions: an imbalance between knowledge transmission and value guidance, where technical implementation is emphasized while humanistic care is overlooked; a disconnect between disciplinary silos and industrial demands, where single-discipline training fails to meet the requirements of interdisciplinary competence; and a separation between innovative thinking and social responsibility, leading to a cognitive deficiency where "technical experts are abundant, but ethical stewards are scarce."

This paper explores ideological and political education reform using the Product Development and Decision Design course as a case study. As a core professional course, it occupies a pivotal position in the curriculum system, connecting general education and supporting subsequent courses. The course collaborates with related disciplines to build a "Smart Rail Transit Product Design" course cluster, aligning with the national strategy of "Building a Strong Transportation Nation" and its demand for interdisciplinary talents. More importantly, through value-led guidance, it shapes students' engineering ethics awareness, making it a vital vehicle for cultivating design talents in the new era who "understand technology, excel in design, and are clear about ethics."

2. Main measures and implementation process of ideological and political education in the course

2.1. Restructuring teaching objectives and content: Establishing a solid foundation for ideological and political education

2.1.1. Restructuring teaching objectives

The integration of ideological and political education into the curriculum is not merely an addition to professional teaching content but an intrinsic enhancement and reshaping of the original knowledge objectives and ability requirements. By systematically deconstructing the course's knowledge system, the ideological value and spiritual connotations embedded within are deeply explored and refined. Using thematic ideological and political education units as the main thread, professional knowledge modules are organically connected and reconstructed. This allows ideological and political education to integrate "silently," like salt dissolving in water, throughout the entire process of project-based learning and practical training. Ultimately, this achieves a sublimation of educational goals: from "mastering knowledge and skills" to "cultivating craftsmanship spirit and deepening patriotism," and from "completing design tasks" to "shouldering social responsibility and upholding technological ethics." The aim is to cultivate outstanding design talents who are both professionally proficient and morally sound.

The course content was systematically reorganized by aligning the course objectives, graduation requirement indicator points in the educational program, and the ideological and political connotations of professional knowledge on a one-to-one basis, see **Table 1**. Guided by the fundamental task of fostering virtue through education, the value guidance of ideological and political education and the designer's spirit are embedded into talent cultivation goals. Based on the Outcome-Based Education (OBE) concept, the moral and intellectual requirements in the student cultivation process are clarified, serving as the standard for formulating the curriculum system and teaching design [1].

Table 1. Traditional knowledge goal vs new goal of ideological and political education in curriculum

Code name	Traditional knowledge goal	New goal of ideological and political education in curriculum	OBE	Graduation requirement indicators
O1	Understand the concepts of product development and design, the process of product development and design, and the impact of enterprises and market on product development and design.	Establish correct design values and industry social responsibility.	yes	1. Mental health 10. Responsibility and Commitment
O2	Understand the current development and application of new materials and technologies in enterprises and markets, as well as cutting-edge design concepts such as design trends.	Cultivate the spirit of innovation and cultural confidence of self-reliance and self-improvement in science and technology.	yes	3. Design Engineering 12. International Perspective 13. Sustainable Development
O3	Develop the ability to effectively investigate, analyze, evaluate, and innovate the product, user, and market.	Strengthen the service consciousness of people-oriented and the scientific spirit of seeking truth from facts.	yes	2. Design Thinking 4. System Design 7. Design Value 9. User Requirements
O4	Master product development and design methods, cultivate innovative design thinking and practical abilities in development and design.	The spirit of craftsmanship and the team character of collaborative innovation are forged.	yes	5. Design Tools 6. Modeling Methods 8. Aesthetic Literacy 11. Cross-divisional cooperation

2.1.2. Reshaping teaching content

Based on the OBE concept, the traditional method of following fixed textbooks and teaching chapter by chapter was abandoned. Knowledge points were deconstructed, and the professional knowledge required for each stage of the product development process was broken down sequentially. Ideological and political education themes were designed based on these deconstructed elements, integrating the key course knowledge points into the analysis of thematic cases, see **Table 2**. Research was conducted on the integrated design of the teaching system for ideological and political education in the curriculum, covering the refinement of ideological elements, forms of embedding, modes of presentation, and teaching methods. Using cases as a vehicle, teaching activities such as lectures, discussions, exercises, and presentations were organized around each thematic unit. This made the teaching content thematic, systematic, and advanced, seamlessly integrating spiritual guidance related to ideals and beliefs into the "moistening things silently" process of knowledge learning [2].

Table 2. Teaching design of four levels of course details: Dao (Principles), Fa (Methods), Shu (Techniques), and Qi (Tools)

Teaching module	Teaching chapter	Knowledge points / integration point of ideological and political education	Thematic training
"Dao" | Concept and Cornerstone	Introduction to Product Development and Design	Clarify "Why Design" A Strong Nation of Quality and the Spirit of Craftsman Teamwork and communication skills Dialectical Thinking and Overcoming Difficulties	Product Development and Policy Regulations
	User demand-oriented thinking innovation	Define "Who to Design For" Fairness and Justice and Humanistic Care Striving for perfection and serving the people Cultural Confidence and Inheritance and Innovation Sustainable Development and Green China	Product Development and Traditional Culture
	Service Design and Product Development	Clarify "How to Design Innovatively" System Thinking and Holistic Concept Innovation-driven and honest management Independent Innovation and National Brand Family and Country Sentiment and the Responsibility of the Times	Product Development and Social Needs

Table 2 (Continued)

Teaching module	Teaching chapter	Knowledge points / integration point of ideological and political education	Thematic training
"Fa" │Process and Method	Product Development Process and Requirements Insight Method	Emphasize data-driven product development Seek truth from facts and scientific spirit Open Learning and National Confidence The Concept of the Rule of Law and the Protection of Privacy	Product Development and Ecological Environment
	Product Development and Innovation Path	Emphasize innovative thinking and ethical responsibility Liberate the Mind and Dare to Be the First Dialectical Materialism and Critical Thinking Integrity Responsibility and User First	Product Development and Innovation and Entrepreneurship
"Shu" │Design and Practice	Practice of User Perceived Deep Mining	Emphasize the user-centered concept Practice First and Truth-seeking People's Democracy and Service Consciousness Opposing Prejudice and Fair Inclusion People-oriented and Mass Line	Product Development and Smart Technology
"Qi" │Tools and Realization	Design Practice and Achievement Display	Emphasize the cutting-edge and commercial aspects of design Technology Empowerment and Subjectivity Cultural Narrative and China Aesthetics Professional Quality and Road Confidence	Export of achievements: 1. Participate in academic competitions 2. Meeting enterprise production needs 3. Entrepreneurship Incubation for the Big Innovation Project

2.2. Innovating teaching models and methods: Activating the driving force of ideological and political education

Based on the OBE concept, the teaching and learning model was innovated, shifting from teacher-led instruction to student-centered inquiry-based learning. Throughout the process, the teacher acts as an organizer, guide, helper, and facilitator, leveraging learning environment elements such as context, collaboration, and conversation to fully stimulate students' initiative, enthusiasm, and creativity [3]. This ultimately achieves the meaningful construction of current knowledge and the mutual promotion and integration of knowledge, ability, and quality objectives.

2.2.1. "Dual-subject" action-oriented teaching

Action-oriented teaching is implemented with students as the main body and teachers as the guides. Team learning replaces independent study, and teacher lectures are replaced by student discussions, presentations, and situational dialogues. Students are guided to make progress through mutual support and challenge, forming a process where teachers guide the learning journey, and students lead the learning outcomes.

Ability objectives are broken down into specific teaching goals and implemented in all teaching links using the action-oriented teaching method. The teacher's role is not as a content expert but as a process expert, with content integrated into the process. Through teaching design, organization, and other links, students are guided to handle tasks or solve problems, allowing them to experience the problem-solving process and apply and transfer knowledge and skills.

2.2.2. Innovation and entrepreneurship practice education

Integrating with the university's "second classroom," innovation and entrepreneurship projects, disciplinary competitions, and academic lectures are incorporated into the teaching process of course modules. This enriches teaching activities while helping students earn second-classroom credits, consolidating the comprehensive and three-dimensional talent cultivation across knowledge penetration, skill enhancement, and behavioral development [4].

2.2.3. Collaborative education through industry-education integration

A tripartite collaborative education mechanism for industry-education integration, comprising "corporate mentors, real-world projects, and practice bases" as shown in Table 3, was established. Corporate mentors participate deeply in the entire teaching process through co-teaching, co-supervising projects, and delivering special lectures on "entrepreneurship." The course introduces real project requirements from enterprises as the driving force for project-based learning (PBL), enabling students to engage in "real projects with real outcomes" from project initiation and development to final defense [5]. Practice bases accept students for project practice and serve as platforms for project incubation, providing early-stage experimentation spaces such as real production and testing environments. Building on this, the course employs diverse practical teaching methods like case studies, situational simulations, and teamwork to transform ideological elements into specific design constraints and action contexts. This allows students to internalize patriotism, legal awareness, craftsmanship spirit, and social responsibility naturally through "doing" while solving real problems, achieving an organic unity of knowledge, ability, and character.

Table 3. Project-based learning (PBL)

Role/subject	Source of project questions	Assignment	Mode of execution
Student	subject competition proposition	Building a learning team, cross-complementary, and collaborative cooperation	Online and offline combined
Lecturer	Innovation and Entrepreneurship Project	Inspire innovative thinking, control academic norms, and provide theoretical support in a timely manner	Online and offline combined
Enterprise mentor	Enterprise R&D requirements	Provide technical implementation guidance, share industry standards, and participate in outcome acceptance reviews	Online and offline combined
Internship and practice base	Commercial Project Production	Project incubation, trial-and-error space, and resource docking	Online and offline combined

2.3. Reforming the assessment and evaluation mechanism: Verifying the effectiveness of ideological and political education

A diversified, action-oriented assessment and evaluation model was introduced. Action learning operates by stimulating students' pursuit of knowledge through mutual assistance, responsible attitudes, and dedicated engagement. In this process, students achieve learning outcomes in knowledge, emotion, and skills. After students complete learning actions, the teacher summarizes or guides students to summarize independently. Students are required to conduct a comprehensive summary of the course content, thereby reinforcing their grasp of relevant theories and comparing the differences with teaching objectives to examine learning

effectiveness. The learning outcomes of action reflection cover not only the learning process but also the level of problem-solving. Therefore, the evaluation method should adopt a comprehensive model that holistically considers multiple dimensions, including students' participation enthusiasm, the roles they undertake, and the final learning outcomes in learning activities.

2.3.1. Dual assessment of "Process + Outcome"

Through continuous teaching reform attempts, the course's grade assessment combines process evaluation and summative evaluation. Process evaluation focuses on ability growth and character development throughout the entire learning cycle. Using various forms such as project logs, peer assessment of team contribution, stage-by-stage defenses, and reflective reports, it primarily examines students' communication and leadership skills in teamwork, the professional ethics and normative awareness demonstrated in project practice, and the continuous improvement and critical reflection abilities shown in iterative design [6], as shown in Table 4. It clearly communicates to students that the core value of this course lies not just in submitting an excellent final assignment but in the growth and transformation experienced throughout the project development process. This effectively guides students to participate more actively in team discussions, bravely express their viewpoints, learn to listen and communicate, thereby truly cultivating the soft skills needed for their future careers. Summative evaluation comprehensively assesses the innovation, completeness, and application value of the final course outcome.

Table 4. Assessment and evaluation methods

Place	Assessment format	Political and ideological assessment points	Score allocation method
In class	Check on work attendance	Sense of time	Class notes
After class	Team role/participation	Team contribution	Team's workload allocation ratio
In class	Team project presentation	Teamwork	Anonymous rating for mini-programs
In class	In-class peer review of team assignments	Critical thinking ability	
In class	Defense of individual assignment results	Express your presentation skills	Anonymous rating for mini-programs
In class	In-class peer review of individual assignments	Self-reflection ability	
After class	Teacher evaluation of group work	Team task completion rate	Teacher/enterprise mentor score
After class	Teacher's evaluation of individual assignments	Student growth and progress / comprehensive abilities	Teacher/enterprise mentor score

2.3.2. Constructing a "Tripartite Evaluation" system

The course innovatively introduces a tripartite collaborative evaluation mechanism consisting of "peer assessment, internal teacher evaluation, and corporate mentor evaluation." This system adheres to a student-centered, outcome-oriented approach. Peer assessment emphasizes experience and resonance, evaluating the creativity, usability, and appeal of projects from a peer perspective, often providing the most authentic and direct feedback. Internal teacher evaluation focuses on the alignment with academic and teaching objectives, systematically evaluating the depth of knowledge application, logical rigor, and completeness of the design process. Corporate mentor evaluation focuses on business and market feasibility, judging from practical

perspectives such as technical implementation difficulty, market potential, cost control, and business model, posing the ultimate question of "whether the market will accept it," as shown in Table 5. The synergy of these three parties not only effectively enhances the comprehensiveness and objectivity of the evaluation but also reflects the exemplary characteristics of the course, integrating the dual objectives of "innovation and entrepreneurship education" and "ideological and political education," truly achieving co-education by multiple subjects and co-evaluation of multidimensional abilities [7].

Table 5. Advantages of the tripartite evaluation system

Subject of evaluation	Core focus	Unique value
Peer review	Team collaboration contribution	Exposing the "free-rider" phenomenon and forcing a sense of responsibility
In-school teachers	Methodological scientificity/technical implementation level	Ensure a solid disciplinary foundation and avoid elementary errors
Enterprise mentor	Market fit/commercialization potential	Injecting real business logic to reduce the idealization of campus

2.4. Strengthening the construction of teaching resources: Consolidating the source of ideological and political education

During the curriculum reform process, a multi-dimensional and three-dimensional teaching resource support system was systematically constructed, laying a solid foundation for the ideological and political education reform driven by the dual core of "industry-education integration + innovation and entrepreneurship."

At the literature resource level, the course integrates core textbooks covering product design processes, user needs analysis, and technical implementation pathways. It gathers classic academic literature on cutting-edge theories such as data-driven design, service design, and innovation methods. It also includes authoritative materials like industry white papers, patent analysis reports, and market research reports, striving to build a multi-level knowledge graph to help students grasp industry trends and theoretical frontiers.

At the practical resource level, the course provides supporting basic teaching documents, including experimental guides, project task sheets, and evaluation standards. It integrates guides and training videos for tools such as CAD/CAE design software, 3D modeling tools, and AI-assisted concept generation. It introduces project materials for both longitudinal research topics and horizontal creative propositions based on real enterprise needs, along with classic teaching cases and business plans for entrepreneurial incubation, providing students with a full-process training path from design concept to final outcome.

At the digital resource level, the course connects to national-level online teaching resource libraries such as iCourse (Chinese University MOOC) and the National Higher Education Smart Education Platform. It integrates teaching video resources covering product prototyping, AIGC concept design, and more [8]. It is supplemented by exercise banks, excellent assignment case libraries, teaching and operation demonstration videos, as well as 3D digital models and interactive animation materials, forming a digital learning ecosystem that integrates online and offline resources.

At the practice base level, the course establishes industry-education integration bases with enterprises under the CRRC Group and companies in the design field. Through deep collaboration in co-teaching, project cooperation, practical training, entrepreneurial incubation, internships, and employment, a collaborative education ecosystem of "industry-education integration + innovation and entrepreneurship" is built between the university and enterprises. This effectively breaks down the barriers between classroom teaching and industrial

practice, achieving a precise alignment between teaching resources and industrial demands [9].

3. Implementation effectiveness and insights of ideological and political education in the course

Through the deep integration of the "project-based learning + ideological and political infiltration" model, the course has achieved significant educational outcomes. From student feedback, over 90% reported that the classroom atmosphere was "both tense and relaxed." The tension stemmed from tight team tasks and the probing questions ("soul-searching questions") from corporate mentors, driving them to actively learn and continuously optimize their solutions in practice. The relaxation came from the open and interactive teaching format, which enhanced their sense of participation and voice. The course not only changed students' perceptions of traditional classrooms but also guided them to shift their focus from purely technical implementation to valuing the social impact and ethical responsibilities of products, achieving a comprehensive improvement in knowledge, ability, and character.

From external evaluations, the Director of the Industrial Design Department at a subsidiary of CRRC Group noted, "These students possess excellent creative thinking, rapid learning abilities, and a high sense of professional responsibility, which significantly distinguishes them from our regular new recruits." A graduate working at BYD reflected that the principles of "responsible innovation" and "user experience inclusivity" emphasized in the course have become core tenets in his product reviews. This feedback confirms that the construction of ideological and political education in the curriculum has formed a win-win pattern of "improved educational quality at university—solid professional foundation for students—access to high-quality talent for enterprises."

The key to the reform of ideological and political education in courses lies in embedding value guidance within the entire process of professional ability cultivation, rather than simply adding it on. Future research will further deepen the innovation of ideological and political education in the context of digital transformation, exploring new models for the deep integration of AI-assisted teaching and ethics education [10]. Simultaneously, it will continue to track graduates' career development trajectories to quantitatively assess the long-term educational effects of this approach, providing a more solid theoretical and practical support for cultivating innovative talents in the new era who "understand technology, excel in design, and are clear about ethics."

Funding

(1) 2023 Liaoning Provincial Graduate Education and Teaching Reform Research Project, "Exploration and Practice of Curriculum Reform Pathways for Industrial Design Engineering Graduate Students in the Era of Generative AI"

(2) 2025 Liaoning Provincial Ordinary Higher Education Undergraduate Teaching Reform Research Project, "Construction and Practical Exploration of an 'AI + Specialized-Innovation-Ideological' Deeply Integrated Teaching Model Oriented towards New Quality Productive Forces"

(3) Ministry of Education of the People's Republic of China, Higher Education Department, 2025 Industry-University Cooperation Collaborative Education Project "Teaching Reform and Practice of Public Aesthetic Education Courses in Universities from the Perspective of Smart Education" (Project No. 2506074315)

Disclosure statement

The authors declare no conflict of interest.

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