

Innovative Practice of an Application-Oriented Talent Cultivation Model Driven by the Dual Wheels of Ideological & Political Cultivation and Industry-Education Integration

Lihua Zhu, Feng Xu, Xue Jiang, Jiazhe Li, Shipeng Sun, Xiye Chen

School of Safety Engineering, Heilongjiang University of Science and Technology, Harbin, Heilongjiang 150022, China

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: Aiming at prominent problems in traditional safety engineering education, such as disconnection between value guidance and knowledge teaching, separation of theoretical teaching and engineering practice, this paper proposes and practices an application-oriented talent cultivation model driven by dual wheels of ideological & political cultivation and industry-education integration. Centered on ideological & political cultivation as the core of value guidance, the model deeply integrates the safety concept of putting people and life first, craftsman spirit and engineering ethics into the whole process of professional education. Taking industry-education integration as the key path of competency training, it strengthens students' ability to solve complex engineering practical problems by building an in-depth coordination mechanism featuring co-construction of courses, sharing of platforms, joint cultivation of teaching staff and collaborative research of projects. After years of practice, this model has effectively improved students' comprehensive literacy and employment competitiveness, forming a replicable reform experience.

Keywords: Ideological & political cultivation; Industry-education integration; Safety engineering; Application-oriented talents; Talent cultivation model

Online publication: September 17, 2026

1. Introduction

Talent cultivation of safety engineering majors bears strategic significance for the modernization of the national work safety governance system^[1]. The traditional talent cultivation model tends to prioritize technical skills over ideological guidance, lacking sufficient value orientation and disconnecting practical teaching from industrial frontiers^[2]. How to cultivate high-quality application-oriented safety engineering talents with solid professional knowledge, advanced technologies, profound national sentiments, rigorous scientific spirit, and a strong sense of responsibility has become the core proposition of current professional education reform^[3]. For this reason, the Safety Engineering major of our university has carried out innovative practice of the dual-wheel-driven talent cultivation model integrating ideological & political cultivation and industry-education

integration, aiming to explore a distinctive new path for cultivating application-oriented safety engineering talents.

2. Theoretical connotation and construction logic of the dual-wheel-driven model

2.1. Definition of core concepts

(1) Ideological & Political Cultivation

Systematically integrate ideological and political elements into the whole process of professional education to forge students' "safety soul", namely firm red-line awareness, commitment to craftsman spirit, conscious compliance with engineering ethics, and strong professional identity, mission and sense of responsibility for national safety undertakings^[4].

(2) Industry-Education Integration

In-depth cooperation between industries and education sectors to realize all-round and whole-process deep integration in aspects including coordinated training objectives, co-construction of curriculum systems, joint management of teaching processes, sharing of teaching staff and co-development of training platforms^[5].

(3) Dual-Wheel Driving

Dual-wheel driving is a figurative and systematic definition of the mutual relationship between ideological & political cultivation and industry-education integration in talent cultivation. The wheel of ideological & political cultivation provides value guidance, spiritual motivation and ethical norms to ensure the correct orientation and noble pursuit of talent training^[6]. The wheel of industry-education integration offers practical scenarios, technical carriers, and competency training to guarantee a realistic foundation and practical efficiency of talent cultivation. The two wheels share the same axis of fostering virtue through education and interlock with mutually embedded elements to boost each other, jointly driving the innovation and practice of talent cultivation models.

2.2. Construction logic and internal correlation

It follows the internal logic of objective integration, path coordination and mechanism guarantee^[7]. At the objective level, the all-round development of morality, intelligence, physical fitness, aesthetics and labor is specified into training objectives for safety engineering majors^[8]. At the path level, industries provide scenarios and materials for ideological education, while ideological & political cultivation injects soul and norms into industry practice, realizing deep mutual embedding^[9]. At the mechanism level, supporting systems including school-enterprise collaborative management, diversified evaluation and incentives, and the development of dual-qualified teachers are established^[10].

3. Innovative practice paths of the dual-wheel-driven cultivation model

Based on the above theoretical construction, the Safety Engineering major of our university has systematically promoted the innovative practice of the dual-wheel-driven model from five dimensions: curriculum system, teaching implementation, platform construction, teaching team and evaluation mechanism.

3.1. Reconstruct a curriculum system with deep integration of values, knowledge and competencies

Break the original linear structure of general basic courses, professional basic courses, professional courses

and practical links. Centered on the core literacy of safety engineers, build a three-tier progressive and horizontally integrated curriculum system consisting of a general education platform (value foundation), a professional education platform (knowledge exploration and competency formation), and an interdisciplinary innovation platform (integration and expansion).

(1) General Education Platform to Consolidate Value Foundation

On the basis of compulsory ideological and political courses, set characteristic elective courses including *Introduction to Engineering Culture*, *Rule of Law and Safety Education* and *College Students' Safety Culture*. Invite enterprise safety directors, model workers, and emergency rescue heroes to deliver lectures in the General Education Lecture Hall to lay a solid safety value foundation for students from the very beginning of enrollment.

(2) Professional Education Platform to Realize Organic Integration

Comprehensively revise the syllabi of professional courses and clarify the “Ideological and Political Mapping and Integration Points” for each course. For instance: Principles of Safety focuses on integrating systems thinking and awareness of objective laws. By analyzing major accident cases, it guides students to recognize the paramount importance of safety and establish a scientific outlook on safety. Safety Management incorporates the thinking of rule of law, sense of responsibility and human-oriented management philosophy. Combined with the revision of the Work Safety Law and the certification of corporate HSE management systems, it fosters students' capability and awareness of law-based and scientific management. Safety System Engineering and Safety Assessment integrate risk awareness, bottom-line thinking and dialectical thinking. Through practices of hazard identification, risk analysis and safety assessment, they cultivate students' professional qualities of being rigorous and meticulous, foreseeing risks and making scientific decisions. Specialized courses such as Electrical Safety Engineering, Mechanical Safety Engineering and Fire Prevention and Explosion Protection Engineering integrate awareness of standards, awareness of specifications and craftsmanship spirit. In conjunction with national standards, industrial codes and enterprise operating procedures, they nurture students' rigorous and pursuit-of-excellence work attitude.

(3) Interdisciplinary Innovation Platform to Highlight Integrated Expansion

Cooperate with partner enterprises to launch micro-specialties and course modules such as Smart Safety & Big Data and Industrial Internet Safety, introducing cutting-edge industrial technologies and real project cases into classrooms. While learning cutting-edge technologies, guide students to discuss emerging issues, including ethical boundaries of technical application, data security, and privacy protection, realizing synchronized progress of value guidance and frontier technology learning.

3.2. Innovate multi-dimensional linked teaching mode of classroom, enterprise and society

(1) Reform Classroom Teaching Methods

Promote case teaching, project-based learning (PBL), scenario simulation and flipped classroom. For instance, in the course Accident Investigation and Handling, adopt a case library based on desensitized real enterprise accident reports. Organize students to simulate accident investigation teams to analyze technical causes, management defects and liability identification from multiple dimensions, and compile investigation reports and improvement suggestions. In this process, liability education, legal education, systematic thinking training and official document writing ability cultivation are completed simultaneously.

(2) Reconstruct Practical Teaching System

Build a five-stage progressive practical system: basic experiments, virtual simulation, comprehensive

training, enterprise internship and innovative projects. Co-build a Work Safety Virtual Simulation Training Center with leading enterprises to reproduce high-risk, high-cost and hard-to-operate scenarios such as chemical explosion and coal mine emergency rescue. Set up enterprise teacher workstations and on-campus supervisor studios to jointly guide curriculum design and graduation projects, with 100% of research topics derived from real enterprise problems.

(3) Empower Second Classroom with Integrated Education

Extend industry-education integration and ideological & political education to the second classroom. Support student associations to cooperate with enterprises to hold Safety Culture Week and Emergency Skill Competitions. Organize students to participate in social lectures during Work Safety Month and community hidden danger inspection volunteer services. Encourage students to apply for College Students' Innovation and Entrepreneurship Training Programs centered on actual enterprise demands, cultivating innovative spirit and practical ability while perceiving the value of engineering serving society.

3.3. Co-build collaborative education platform integrating virtual and real resources

(1) Co-Construct Physical Practical Platform

Jointly build a Safety Engineering Industry-Education Integration Innovation Practice Base with enterprises, integrating teaching, training, research and training functions. Enterprises donate or share partial equipment, while universities provide venues and basic supporting facilities to develop modern training programs jointly.

(2) Co-Construct Virtual Teaching & Research Platform

Utilize information technology to build a professional teaching case library of safety engineering (covering ideological and political cases and engineering cases), a safety accident virtual simulation resource library, and massive open online courses (MOOCs). Universities and enterprises jointly develop and share resources both on and off campus. Enterprise specialists can deliver remote lectures, graduation project guidance and technical seminars via the platform.

(3) Co-Construct Technology R&D and Service Platform

Establish joint university-enterprise research teams relying on the platform to jointly apply for vertical research projects and tackle enterprise technical difficulties. Encourage students to participate in research projects at an early stage, engaging in experiments, data analysis, and report writing to cultivate scientific literacy and the ability to solve complex problems in authentic research environments.

3.4. Build a dual-qualified teaching team with noble ethics and professional proficiency

(1) Implement Two-Way Cross-Employment System

Invite enterprise technical backbones and safety directors to serve as industrial professors or part-time tutors for regular lectures, seminars and practical guidance. Select young professional teachers to work as visiting engineers in partner enterprises for half a year to one year, fully participating in enterprise technical or management work to accumulate engineering experience.

(2) Establish Regular Teaching & Research Mechanisms

Hold regular workshops on integrating curriculum ideology with professional teaching and industry-education integration teaching salons. Invite ideological & political experts, enterprise specialists and professional teachers to jointly discuss teaching design and share cases, improving teachers' ability to design and implement dual-wheel-driven teaching activities.

(3) Reform Teacher Evaluation Mechanism

Take achievements in curriculum ideological construction, industry-education integrated courses, student internship guidance, and university-enterprise cooperative research as important indicators in professional title evaluation, merit evaluation, and awards, stimulating teachers' enthusiasm for reform.

3.5. Improve multi-participant and process-oriented evaluation & feedback mechanism

(1) Comprehensive Student Evaluation

Establish a comprehensive evaluation system combining knowledge assessment, competency evaluation and value observation. Adopt diversified forms including project reports, research papers, scheme design, practical assessment and oral defense. Evaluation criteria cover teamwork, communication skills, sense of responsibility, ethical consideration and innovative thinking. Introduce evaluation by enterprise tutors during internships and graduation projects.

(2) Continuous Teaching Evaluation

Build a feedback tracking mechanism for graduates and employer evaluation channels. Regularly collect feedback on graduates' career development and employers' opinions on talent cultivation, which serve as an important basis for revising training programs and improving teaching.

(3) Two-Way Cooperative Evaluation

Set up an assessment mechanism for university-enterprise cooperation effects. Universities evaluate enterprises' contributions to talent cultivation, while enterprises assess the quality of graduates and technical support provided by universities, promoting continuous deepening and mutual benefit of cooperative relations.

4. Practical achievements and popularization value

After years of exploration and practice, remarkable results have been achieved under the dual-wheel-driven cultivation model.

4.1. Significant improvement of student cultivation quality

(1) Enhanced Value Recognition and Professional Literacy

Over 90% of students expressed a deep understanding of the value of safety work and established solid red-line awareness according to various surveys and interviews. Students demonstrated rigorous, responsible and standardized working attitudes during internships and projects, winning high recognition from enterprises.

(2) Improved Engineering Practice and Innovative Competence

In the past three years, students have won more than 50 provincial-level and above discipline competition awards, including 3 national prizes. The number of student papers and patent applications grows year by year. Over 85% of graduation projects originate from real enterprise issues with greatly improved quality.

(3) Higher Employment Competitiveness and Social Recognition

The graduate employment rate has remained above 90% for consecutive years, with a high major matching ratio. A large number of graduates are recruited by well-known cooperative and leading enterprises with competitive starting salaries and promising career prospects. Employers generally comment that graduates possess strong safety awareness, quick adaptability and sustainable development potential.

4.2. Fruitful achievements in teaching resources and faculty construction

(1) High-Quality Teaching Resources Developed

1 provincial excellent curriculum ideological case, 5 characteristic textbooks, 50 cases and 5 virtual simulation experimental programs co-developed by universities and enterprises.

(2) High-Level Teaching Team Formed

The Safety Engineering teaching team has been rated as a provincial leading talent echelon.

(3) High-Level Education Platform Established

The comprehensive Safety and Emergency Practical Platform under the national 14th Five-Year Education Development Project and provincial college student practice centers has been built to support safety engineering talent cultivation.

4.3. Extensive demonstration and social influence

(1) Widely Exchanged Reform Experience

Relevant research results have been delivered as special reports 3 times at national Safety Science and Engineering Teaching Steering Committee conferences and provincial teaching reform seminars, receiving wide attention and recognition from peer universities.

(2) Model Adopted by Multiple Institutions

More than 13 domestic universities offering safety engineering and related majors have visited our university for exchanges, adopting part of our talent cultivation concepts and reform measures.

(3) Improved Social Service Capacity

Relying on the industry-education integration platform, more than 200 safety technical consultations, risk assessments and staff training services have been provided for cooperative enterprises and local micro, small and medium-sized enterprises, generating sound economic and social benefits and lifting the professional social contribution.

5. Conclusion and prospect

Targeting the pain points in cultivating application-oriented safety engineering talents, this paper proposed and practically verified the dual-wheel-driven talent cultivation model combining ideological & political cultivation and industry-education integration. Practice proves that this model effectively solves the disconnection between value guidance and knowledge teaching, as well as the separation of theoretical study and engineering practice, realizing high-quality implementation of the fundamental task of fostering virtue through education in engineering majors and significantly improving the pertinence and effectiveness of talent cultivation. The success of the dual-wheel model lies in three key points: consistent objectives with value shaping prioritized; mutually supportive paths where ideological education deepens industry practice and industry platforms optimize value guidance; coordinated mechanisms to stimulate internal motivation of both universities, enterprises, teachers and students.

Looking ahead, talent cultivation of safety engineering will be profoundly affected by new rounds of technological and industrial revolution, as well as new requirements put forward by the national holistic security concept for the comprehensive safety framework. Further deepening directions are clarified as follows: First, integrate digital and intelligent technologies, explore the “Intelligence +” safety engineering talent training mode, introduce big data, artificial intelligence and digital twin technologies into courses

and practical training, and study emerging safety ethics issues in the intelligent era. Second, expand the connotation of industry-education integration from single enterprise cooperation to in-depth linkage with industrial clusters, industrial parks and industry associations, building a more open education ecosystem. Third, reform the evaluation system to establish a more scientific and dynamic assessment mechanism that fully reflects students' comprehensive literacy and long-term development potential.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Wang Q, Ren X, You B, et al., 2025, Reform of Integrating the Holistic National Security Concept into Safety Engineering Training Programs. *Safety*, 46(8): 54–60.
- [2] Tang M, Qiu J, Zhou L, et al., 2025, Exploration and Practice of Theory-Practice Integrated Education Model Under the Background of Double First-Class Construction — A Case Study of Safety Engineering Major. *Safety and Environmental Engineering*, 32(6): 135–143.
- [3] Ding Z, 2026, Characteristics and Reflections on 133 Typical Cases of Industry-Education Integration in 2024. *Southern Metals*, (3): 82–85.
- [4] Zheng Z, 2019, Exploration on Innovative Integration Model of Curriculum Ideology and Professional Education — From the Perspective of Financial Management Major. *Enterprise Science and Technology & Development*, (3): 72–73.
- [5] Ding D, Zhang J, Zhu Y, 2026, Research on the Path of Building Industry-Education Integration Community Through Undergraduate and Higher Vocational Collaboration. *Higher Architectural Education*, 35(3): 28–34.
- [6] Wei Y, 2026, Xi'an University of Architecture and Technology: Cultivating Top Innovative Talents Through Five-Dimensional Coordination. *Shaanxi Education (Higher Education Edition)*, (4): 10–11.
- [7] Lu H, Zhang X, Zhang J, 2022, Exploration on Optimization and Guarantee Mechanism of School-Enterprise Collaborative Education Path for Food Majors. *Innovation Theory and Practice of Entrepreneurship*, 5(12): 141–143.
- [8] Jiang Y, Pan J, Chu J, 2020, Research on Paths and Guarantee Mechanisms of School-Enterprise Collaborative Education in Local Undergraduate Universities. *Innovation Theory and Practice of Entrepreneurship*, 3(23): 187–189.
- [9] Huang G, Jiang P, 2026, Research on Five-in-One Innovative Model of School-Enterprise Collaborative Practical Education for Civil Engineering Majors. *Journal of North China University of Technology*, 38(1): 68–76.
- [10] Shao C, Li S, 2024, Research and Practice of Student-Centered Classroom Revolution with Multi-Source Supply and Diversified Evaluation. *Shanxi Youth*, (4): 57–59.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.