

Research on the Construction of an AI Practical Education System for the Safety Engineering Major from the Perspective of the Integration of Industry and Education

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Abstract: Against the background of emerging engineering construction and digital reform of industry-education integration, aiming at the problem that the traditional practical-training mode of the safety engineering major lags behind the development demands of industrial intelligent safety, this paper focuses on the construction of the AI practical-education system for this major. It systematically analyzes practical difficulties existing in the current system, including insufficient resource circulation, loose connection between posts and courses, and solidified practical-training modes. Combined with professional teaching rules and industrial post standards, targeted optimization strategies for practical education are put forward from three dimensions: resource iteration, post-course integration and mode innovation, and the strategies are verified through professional practical-training courses. This research effectively makes up for the shortcomings of traditional practical-training teaching and can provide references for the digital practical-teaching reform of the safety engineering major and the cultivation of compound intelligent-safety talents.

Keywords: Integration of industry and education; Safety engineering; AI practical training; education system

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1. Introduction

In accordance with requirements of documents such as *Outline for the Construction of a Powerful Country Through Education* and *Action Plan for "Artificial Intelligence + Education"*, we shall vigorously promote industry-education integration, update practical-training education methods with digital technologies, build school-enterprise collaborative practical-training bases relying on city-level industry-education consortia, and cultivate compound engineering talents adapted to industrial intelligent transformation. At present, industries including industry-mining and emergency management have comprehensively adopted AI intelligent monitoring and virtual emergency-drill technologies. Traditional practical training for safety engineering major is confronted with problems such as restricted practical operation in high-risk scenarios, disconnection between school-enterprise resources and backward training scenarios for risk disposal. The

existing education system cannot meet the demands of intelligent-safety posts in the industry. Guided by industry-education-integration policies, we shall leverage AI virtual simulation and intelligent practical-training platforms to connect school-enterprise education chains, build an education system integrating scenario-based practical training, process-oriented evaluation and joint project cultivation, solve practical-teaching problems in safety engineering, and cultivate professional talents with intelligent risk-control capabilities for industrial development, which constitutes an urgent demand for current major-oriented reform ^[1].

2. Significance of constructing the AI practical-education system for safety engineering major from the perspective of industry-education integration

Policies for emerging-engineering construction and industry-education integration keep advancing the digital transformation of practical teaching for engineering majors. The discipline of safety engineering faces the inherent teaching limitation that practical training for high-risk operation scenarios cannot be implemented. Building school-enterprise collaborative practical-education carriers with artificial-intelligence technologies can reshape the basic logic of professional talent cultivation. As capability standards for new-type posts such as industrial intelligent-safety monitoring, digital emergency disposal and AI risk prediction keep updating, traditional offline practical-training sites, equipment and practical-operation scenarios fail to keep pace with iterative industrial technologies. The school-enterprise-isolated talent-cultivation mode leads to a large gap between talent-capability supply and industrial post demands ^[2]. To construct an integrated AI practical-education framework, it is necessary to establish an industry-education coordination mechanism, open channels for circulation of real-enterprise safety data, intelligent simulation systems and on-campus teaching resources, conduct training on extreme-accident disposal that cannot be reproduced offline through virtual deduction and intelligent risk simulation, and reduce safety hazards as well as site and consumable costs of physical practical training ^[3].

3. Difficulties in constructing the AI practical-education system for safety engineering major from the perspective of industry-education integration

3.1. Insufficient circulation of school-enterprise resources and backward AI practical-training contents

Leading enterprises in the industry possess dynamically updated safety-monitoring algorithms, accident-simulation datasets, and intelligent management-and-control equipment, which constitute important digital practical-training resources. A series of conditions such as data confidentiality and property-right division restrict their external sharing. On-campus teaching platforms can only carry basic standardized simulation modules and cannot correspond to application scenarios of cutting-edge industrial intelligent-safety technologies. Colleges and enterprises have not established normalized mechanisms for co-construction and sharing of resources. Resource docking between both sides mostly stays at shallow-level cooperation such as short-term visits and one-off lectures. Unified data-interaction ports and resource-co-construction management systems are absent. Latest intelligent-safety project cases from enterprises cannot be continuously converted into in-class practical-training materials ^[4].

3.2. Loose connection between post-oriented practical training and courses, low education adaptability

Digital-competency assessment standards with clear hierarchies have been formed for intelligent-safety posts in emergency-management and industry-mining industries. Post practical-operation links put forward specific requirements for comprehensive capabilities including AI-system operation, risk-data research-and-judgment and intelligent-equipment operation-and-maintenance. Enterprise technical backbones are not deeply involved in the compilation of professional talent-cultivation schemes. Practical-training modules are divided according to traditional disciplinary-knowledge frameworks instead of being reconstructed in a modular way based on post-capability dimensions ^[5]. Practical-teaching links are dominated by theoretical-algorithm demonstration and basic software operation. There is a lack of design connecting complete post-work processes. Students finish individual intelligent-practical-training tasks in segments and cannot form professional thinking covering on-site investigation, data analysis, and the whole emergency-disposal process ^[6].

3.3. Solidified intelligent practical-training modes and weak innovative-education efficiency

Most AI-safety practical-training platforms built by colleges still adopt one-way demonstration-oriented teaching modes. With pre-set operation procedures and standard accident-deduction routes on platforms, students can only adjust parameters and view results following fixed procedures. Platforms do not open functions for independent modeling and custom accident-scenario editing, which greatly reduces students' room for independently designing digital-safety schemes. The whole practical-teaching process relies on standardized training tasks uniformly arranged by teachers. Open practical-training projects based on real-enterprise safety-production problems are not created. Practical-training evaluation mainly takes task-completion degree as the judging criterion, without establishing hierarchical-evaluation mechanisms for scheme innovation and differentiated thinking in risk research-and-judgment ^[7].

4. Construction strategies of the AI practical-education system for safety engineering major from the perspective of industry-education integration

4.1. Aggregate high-quality school-enterprise resources and iterate AI practical-training contents

Instructors shall take the lead in establishing a two-way school-enterprise resource-circulation and-cooperation mechanism, formulate standardized collaborative-management detailed rules for industrial-data property rights and practical-training-material sharing, and open channels for docking enterprise intelligent-safety databases, real-scene simulation models with teaching scenarios. Teachers shall participate in school-enterprise joint resource-research-and-development work, conduct teaching-oriented processing on enterprises' cutting-edge intelligent-monitoring algorithms and dynamic-accident-simulation materials, and convert them into modular teaching materials suitable for in-class training after removing confidential industrial information. A normalized material-update-and-maintenance system shall be established. Teachers shall keep timely contact with enterprise technical departments to learn about the latest achievements of industrial intelligent-management-and-control technologies, and purposefully upgrade and improve practical-training-platform models and deduction scenarios inside the college ^[8].

For instance, in the course *Intelligent Safety-Monitoring Simulation Training*, teachers shall take the initiative to contact digital-safety-operation-and-maintenance departments of local industry-mining enterprises, sign non-disclosure agreements for teaching-resource sharing, and obtain enterprises' real-time

equipment-risk-collection datasets and original AI-visual-recognition hazard-simulation models. Centering on machine-vision-based risk identification and multi-dimensional-monitoring-data fusion-processing within the course, teachers conduct layered desensitization processing on original enterprise materials. After removing confidential production parameters, special-purpose plant-equipment serial numbers and capacity-related sensitive information, lightweight simulation modules adapted for phased in-class training are split into two training levels: basic-recognition exercises and complex-working-condition recognition. In accordance with the monthly-course-update system, teachers shall finish converting materials of newly-launched enterprise intelligent-early-warning-system at the end of each semester, reconstruct knowledge points such as sensor-data fitting and AI deduction under abnormal working-conditions into practical-training operation tasks, and supplement relevant handouts for data-processing practice and key-points for knowledge-point application corresponding to different simulation models. Meanwhile, a school-enterprise-interconnected material-storage partition shall be created on campus practical-training servers to enrich industrial materials for new-type underground-intelligent-inspection-simulation scenarios continuously. Processed industrial materials are adopted for in-class practical-training exercises, enabling learners to practice monitoring-algorithm operations with the latest industrial-digital materials. This makes up for teaching deficiencies caused by backward technologies in previous practical-training materials, helps students better understand the real-operation logic of industrial-site AI-monitoring systems, and breaks barriers between theoretical knowledge points and industrial practical-operations.

4.2. Deepen post-course integration and precisely meet post demands

Teachers shall take part in the whole process of jointly revising talent-cultivation schemes by colleges and enterprises, conduct in-depth research on complete evaluation dimensions for intelligent-safety posts, reconstruct internal structures of practical-training courses with digital working logics of posts, and break the fixed mode of segmented teaching based on traditional disciplinary knowledge points. Teachers shall split AI practical-training modules according to whole-process post-work-chains, decompose core post capabilities such as intelligent-data research-and-judgment and digital emergency disposal into practical-teaching links at each stage, and build coherent and complete practical-training logical threads ^[9]. Internal logics of practical-training assessment and evaluation shall be adjusted. Teachers shall introduce capability-judgment dimensions for front-line enterprise posts into on-campus practical-training scoring systems, reduce assessment weights for single theoretical results, and attach importance to judgment on comprehensive qualities in digital practical-operation processes.

For example, in the course *Digital Emergency-Risk-Control Training*, teachers shall fully participate in seminars for jointly formulating post-capability standards by colleges and enterprises, sort out core-capability indicators for whole-process-data-research-and-judgment and AI-accident-simulation disposal for intelligent-safety-control posts, reconstruct knowledge points of big-data risk modeling and multi-scenario emergency-linkage deduction for the course, and form new practical-teaching modules. Teachers shall abandon the previous teaching mode of dividing practical-training tasks by theoretical chapters, connect complete enterprise-post work-order workflows into layered-training contents, integrate knowledge points of risk-data cleaning, intelligent-early-warning-threshold debugging and digital-emergency-plan generation into continuous practical-training procedures, and rearrange practical-training class hours following post-work sequences: on-site investigation, data modeling, risk research-and-judgment and scheme output. Course-assessment detailed rules shall be revised synchronously. Practical-operation-evaluation standards for front-line enterprise

posts shall be incorporated into practical-training scoring systems. Assessment weights for indicators including digital-scheme design and multi-dimensional comprehensive hazard research-and-judgment shall be increased. Scoring detailed rules for knowledge points corresponding to each practical-operation link shall be specified, and process-oriented learning contents such as students' modeling logics and parameter-debugging ideas shall be recorded. The whole set of practical-teaching conforms to the digital-working logics of posts. Learners form complete professional-problem-solving thinking in continuous practical-training exercises, narrowing gaps between on-campus practical-training capabilities and enterprise-post practical-operation requirements. Students can develop post-work thinking in advance on campus and shorten their adaptation period after taking up jobs.

4.3. Innovate intelligent practical-training paradigms and improve comprehensive education efficiency

Teachers shall adjust the underlying logic of AI practical-training classrooms, abandon one-way process-demonstration training modes, open permissions for independent modeling and custom risk-scenario editing on practical-training platforms, and design digital-training tasks with space for independent exploration. Forms of practical-training classrooms shall be reorganized. Open-ended training tasks shall be designed centered on real-industrial digital-safety problems. Rigid requirements for standardized operation steps shall be weakened, allowing learners to independently build risk-deduction models and generate different disposal schemes. Logics for layered practical-training evaluation shall be improved. Teachers shall enrich evaluation-indicator dimensions, add judging items for scheme innovation and complex-hazard-research-and-judgment thinking, and reduce the single-indicator weight of task-completion degree^[10].

For example, in the course *Comprehensive AI-Based Accident Deduction Training*, teachers shall remove inherent standardized-operation restrictions of platforms, grant permissions for independent simulation-scenario modeling and custom risk-parameter editing, and arrange open-ended practical-training tasks focusing on multi-coupling-accident modeling and optimized-design of intelligent-disposal schemes within the course. Teachers shall no longer set fixed operation procedures and unified deduction-result standards. Training subjects without fixed answers shall be assigned based on knowledge points of complex industrial compound hazards. Learners may independently select monitoring algorithms, set risk-triggering conditions and superimpose various hazard sources. Sufficient time shall be reserved in class for students to debug models independently. A diversified course-evaluation system shall be reconstructed. Multiple judging criteria, including model innovation degree, complex-hazard-prediction logic, and scheme feasibility, shall be added, and the scoring proportion for single-task completion shall be reduced. Teachers shall sort out students' self-built deduction models one-by-one and identify strengths and deficiencies in knowledge-point application. The implementation framework for open-ended practical training fully gives play to learners' independent exploration space. Comprehensive-modeling knowledge points of the course are adopted to cultivate learners' comprehensive qualities of independently utilizing intelligent tools to handle unconventional safety hazards, improve innovative-training values of practical-teaching, urge students to get rid of template-based operation thinking, and form digital-engineering capabilities for independently solving complex industrial-safety problems.

5. Conclusion

To sum up, this paper mainly studies construction paths for the AI practical-education system of the safety

engineering major under the guidance of industry-education-integration policies. It sorts out practical obstacles in building the AI practical-education system for the safety engineering major from the aspects of resource inter-circulation, post-course matching, and practical-training modes. Combined with engineering practical-teaching logics, it puts forward optimized implementation paths feasible for teachers' teaching practice, which are verified in real-scenario implementation via professional practical-training courses. Starting from industrial demands for intelligent-safety transformation, this paper organically integrates school-enterprise-collaboration mechanisms, digital practical-training carriers and core professional knowledge points, and forms operable teaching-implementation methods, filling gaps of insufficient practicality and low talent-adaptability in traditional safety-related practical training. The research conclusions improve relevant theories for digital practical-teaching of safety majors in the context of emerging-engineering education, and provide referable construction ideas and in-class-implementation paradigms for similar engineering majors to promote industry-collaborative practical-training reform with artificial-intelligence technologies.

Disclosure statement

The authors declare no conflict of interest.

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