

CURRICULUM IDEOLOGICAL AND POLITICAL EDUCATION IN ENGINEERING MANAGEMENT UNDER A NATIONAL-LEVEL FIRST-CLASS UNDERGRADUATE MAJOR CONSTRUCTION POINT: REFORM, PRACTICE, AND PROSPECTS

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Abstract: This research, set against the backdrop of the national first-class undergraduate major construction points, focuses on the reform and practice of ideological and political education in engineering management courses. In response to problems such as "rigid embedding, single methods, insufficient practical chains, and the absence of an evaluation system", it proposes a "four-in-one" reform model centered on OBE, integrating goal reconstruction, content reengineering, method innovation, and evaluation reform. By building an ideological and political case library and a course ideological and political map, a 1+1+1 multi-dimensional evaluation system is formed, and the collaboration of school and enterprise dual teachers and resource co-construction are promoted. Taking "Project Management" as a pilot, a three-stage teaching of "pre-class online inspiration - in-class situational exploration - post-class ethical assessment" is carried out, highlighting professional ethics and social responsibility in risk management, and promoting the organic unity of knowledge, ability, and values. Preliminary results show that the scores of assessment methods such as situational analysis have significantly improved, students' professional qualities, ethical judgment, and cross-disciplinary collaboration abilities have been enhanced, and the course resources have achieved scale and demonstration. The sharing of resources among schools and the integration of industry and education have achieved remarkable results, with good prospects for promotion. This model has strong transferability and can provide an operational reference model and implementation path for similar majors.

Keywords: National first-class undergraduate major construction sites; Curriculum ideological and political education; Engineering management; Implementation path

1 THE MOTIVATION AND OBJECTIVES OF TEACHING REFORM

1.1 Reasons for Reform

1.1.1 An inevitable requirement for implementing the national education strategy

In order to fully implement the fundamental task of moral education (cultivating virtue) and the connotation-driven development of the national-level first-class undergraduate major construction, universities must advance the collaboration of general education and professional education. The Ministry of Education has successively issued the "Guiding Outline for the Construction of Ideological and Political Education in College Courses" and the "Comprehensive Promotion of Large-scale Ideological and Political Education" work plan, emphasizing the comprehensive embedding of ideological and political elements in general and specialized courses to achieve all-round, all-staff, and all-process education. For majors such as engineering management, it is necessary to take course-based ideological and political education as the carrier, promote the coordinated development of professional education and ideological and political education, and form a systematized, standardized and regularized operation of ideological and political education in professional courses, enhancing the political, ideological and social responsibility of talent cultivation. As a national first-class undergraduate major construction point, we shoulder the exemplary mission of leading the development of the major and outputting outstanding talents. This means that major construction must not only be satisfied with the completeness of the knowledge system and the cutting-edge of technology, but also must give an excellent answer to the fundamental question of "for whom and what kind of people to cultivate". Therefore, taking course-based ideological and political education as the core connotation of major construction is an inevitable choice to respond to the national call and implement the "all-round, all-staff and all-process education" pattern, and is also a concentrated manifestation of the "value guidance" function of first-class majors[1].

1.1.2 Realize the internal logic of connotative development and the upgrading of talent cultivation

The national first-class undergraduate major construction sites emphasize connotative development. They require efforts

to be made in integrating value shaping, professional qualities, and technical capabilities. Their ultimate output is the core carrier of high-quality engineering talents. It is necessary to cultivate outstanding talents with a sense of national responsibility, craftsmanship spirit, and engineering ethics, and promote the alignment of the curriculum system, teaching resources, and evaluation mechanism with industry needs and national strategies. It not only requires students to master solid professional technologies but also to possess a profound sense of national responsibility, a rigorous craftsmanship spirit, a social responsibility of abiding by engineering ethics, and a project management vision that is in line with international standards[2]. The traditional professional education model already has a mature system in "cultivating talents" but has shortfalls in the in-depth integration of "cultivating people"[5]. It is essential to cultivate new-era engineers who combine technical capabilities and a sense of national responsibility. Also, taking the integration of industry and education as a starting point, deepen school-enterprise cooperation, and build a "2+N" segmented training, dynamically updated curriculum system and practical platform. This enables students to form good professional ethics and social responsibility while mastering cutting-edge information technologies (such as intelligent construction, BIM, big data, etc.).

1.1.3 Urgent response to existing teaching bottlenecks

- 1) The "rigid embedding" of CIPE can lead to "two skins" where CIPE elements seem tag-like and out of touch with enterprise culture; embedding is often superficial[3,4].
- 2) Teaching methods are too homogeneous, with low student engagement; traditional theory-driven instruction leaves students passive and prevents internalization of CIPE values.
- 3) Incomplete practical teaching chains and insufficient collaborative education make it difficult for schools' unilateral curriculum construction to align with the demands of enterprises. The construction of ideological and political education in courses often relies on the individual efforts of professional teachers and fails to effectively form the synergy of collaborative education among multiple subjects such as ideological and political teachers, enterprise mentors, and counselors.
- 4) The teaching effect is difficult to measure scientifically. The traditional course evaluation method is difficult to conduct effective, dynamic and long-term assessment of ideological and political education effects such as value shaping, resulting in the inability to precisely measure and continuously improve the reform effect[10,11].

In summary, to address these issues, comprehensive reforms are needed to be implemented. Establish diversified ideological and political resource packages and course case libraries, and form school-enterprise dual-teacher and school-enterprise collaborative education teams; Establish a dynamic, three-dimensional evaluation system (a 1+1+1 model that combines student self-evaluation, enterprise mentor assessment, and school assessment), and integrate ideological and political education into the entire chain of curriculum design, teaching process, and academic evaluation. Through these reforms, we can achieve a deep integration of professional teaching quality and ideological and political education, and cultivate new era engineering management talents who have both professional capabilities and a sense of patriotism.

1.2 Goals of the Reform

Based on a deep analysis of the driving forces of the reform, this reform of ideological and political teaching in engineering management courses aims to fundamentally solve the "two skins" problem and achieve a deep integration of value guidance and professional education. Our goal is not to patch up the existing teaching system from scratch, but to carry out a systematic reshaping and upgrading.

1.2.1 Overall objectives

Build a teaching model of ideological and political education for engineering management courses with the OBE (Outcome-based Education) concept as the core, which integrates value shaping, knowledge imparting and ability development, and is operable, assessable and scalable[6]. This model will be one of the landmark achievements of the national first-class major construction point of our university, aiming to provide a set of effective "reference paradigms" and "solutions" for the construction of ideological and political education in courses of related majors in similar universities.

1.2.2 Specific goals

- 1) Achieve the goal of "seamless integration" and "genetic fusion" of ideological and political elements with professional knowledge and capabilities.

Completely abandon the "labeling" style of rigid grafting and promote the transformation of ideological and political elements from "physical pasting" to "chemical reaction". Specifically, it involves systematically deconstructing and precisely anchoring ideological and political elements based on the knowledge graph and competency matrix of engineering management.

- 2) The goal of establishing an immersive and interactive teaching method system that integrates the way into teaching and the virtue into learning.

Change the old situation where teachers one-way indoctrination and students passively accept, and build a new teaching paradigm centered on students and featuring two-way interaction between teachers and students[7]. The core is to vigorously promote modern teaching methods such as case teaching, project-based learning (PBL), scenario simulation and role-playing.

- 3) The goal of establishing a diverse, dynamic and measurable mechanism for evaluating the effectiveness of ideological and political education in courses.

Overcome the bottleneck of "difficulty in measuring teaching effectiveness" and change the previous evaluation methods that relied on a single final paper or subjective feelings. We will build a comprehensive evaluation system that involves multiple subjects, emphasizes both process and outcome, and combines quantitative and qualitative methods.

2 CORE IDEAS AND OVERALL DESIGN OF TEACHING REFORM

2.1 Core Ideas

One is student-centered. Teachers shift from knowledge transmitters to learning facilitators, learning designers, and feedback guides by designing learning paths around learners' needs, differentiated starting points, active inquiry, and collaborative learning.

The second is output-oriented (OBE). Starting with clear learning outcomes, covering the three-dimensional outputs of knowledge, ability, and attitude, curriculum objectives, teaching processes, and evaluations are all designed around outcomes, forming an evidence-based, comparable, and traceable evaluation chain.

The third is implicit education. Through potential educational influences such as campus culture, teacher-student interaction, professional ethics and social responsibility, it permeates the context outside the curriculum to shape professional qualities and patriotism. The three support each other and drive the coordinated advancement of curriculum design, teaching implementation and evaluation, ensuring the organic unity of knowledge, ability and values.

2.2 "Four-in-One" Reform Model

The four-in-one is not a simple juxtaposing, but a system that works in synergy with closed-loop feedback. Implement the requirements of ideological and political education to the learning objectives at the course and unit levels to ensure the unified output of professional knowledge with professional ethics and social responsibility[8]; Explore and integrate ideological and political teaching resources, improve case libraries, resource packages, and school-enterprise co-construction materials to form a reusable resource system; Adopt multiple strategies such as contextualization, case-driven, project-based learning, immersive teaching, and integration of online and offline to enhance students' participation and practical application ability; Establish an evaluation system that emphasizes both process-oriented and developmental aspects, with a comprehensive evaluation based on diverse evidence such as learning portfolios, outcome presentations, and enterprise/industry assessments.

3 SPECIFIC IMPLEMENTATION PATHS OF TEACHING REFORM

To ensure that the reform ideas and the overall design take root, this project has planned four clear and operational parallel paths to systematically promote ideological and political teaching in the curriculum from "likeness" to "spirit", from "part" to "whole".

3.1 Reconstruction of Teaching Objectives - from "Knowledge-Based" to "Value-Knowledge-Ability" Trinity

Reconfiguring teaching objectives is the starting point of all reforms. We must precisely translate ideological and political requirements from a macroscopic educational concept into specific and measurable teaching guidance for each class.

Take the Project Management course as an example and carry out exemplary reconstruction. In Project Management, the teaching objective will go beyond the traditional expression of "mastering the three major control methods of schedule, cost, and quality" and upgrade to the knowledge level of explaining the principles of core tools such as WBS and network planning technology; The level of being able to prepare project plans and having the comprehensive ability to deal with project risks; Through strict schedule and quality control practices, deeply understand and internalize the craftsmanship spirit and professional ethics of "quality first for a century-long project"[9]; By simulating the handling of engineering safety emergencies, establish the value level of engineering ethics and social responsibility that "life comes first, safety is more important than Mount Tai."

Through this "trinity" goal statement, ideological and political requirements are no longer an additional "label", but an inherent dimension that is seamlessly integrated with professional knowledge and ability cultivation, providing a fundamental guideline for the design of subsequent teaching content and methods.

3.2 Reengineering of Teaching Content - Building an "Ideological and Political Case Library" and a "Course-based Ideological and Political Map"

After the objective is restructured, organized and systematic teaching content is needed to support it. We are committed to elevating ideological and political elements from "scattered mining" to "systematic integration".

Building a "curriculum-based ideological and political case library" is the core carrier of content reengineering. We will organize teaching teams to systematically collect and compile two types of cases.

Positive examples, such as the Hong Kong-Zhuhai-Macao Bridge, are backed by the innovative spirit of overcoming difficulties, the craftsmanship of millimeter-level precision control, and the ecological ethics of protecting the Chinese white dolphin; Take the tender of the Lubuge Hydropower Station as an example to illustrate the spirit of the rule of law

and the spirit of contract in market competition.

Negative cautionary cases, such as an analysis of "a large bridge collapse accident", trace ethical misconduct and lack of responsibility in its design, construction or materials; Analyze the case of "a project was halted due to environmental impact assessment fraud" and emphasize the bottom line of integrity and social responsibility in engineering decisions.

3.3 Innovation in Teaching Methods - From 'Teacher's Lecture' to 'Student Experience'

No matter how good the content is, if it is taught in a dull way, the effect will be greatly reduced. The core of method innovation is to transform students from passive listeners to active perceivers and constructors.

In the Project Management course, set up a virtual project that includes the ethical dilemma of "discovering that the use of inferior materials can significantly reduce costs and is imperceptible", and students must confront and deal with this ethical dilemma while completing the project tasks and write decision reports.

Project-based teaching that involves in-depth discussions around the positive and negative cases in the ideological and political case library.

The core of these methods is to create a classroom environment of "high engagement, high interaction, high thinking", allowing students to complete the self-construction and internalization of values through personal experience and the collision of ideas.

3.4 Reform of Teaching Evaluation - From "Testing Knowledge" to "Assessing Competence"

Teaching evaluation is the baton. To ensure the effectiveness of the first three paths, a corresponding evaluation system must be established to effectively measure the effectiveness of "value shaping".

Add open-ended scenario analysis questions to the final test paper. For example, give a scenario of "tight schedule conflicting with construction safety regulations" and ask students not only to propose technical solutions but also to explain the ethical principles and value order on which their decisions are based, in order to test their intrinsic value judgment.

Significantly increase the proportion of regular grades and refine it. The quality of students' presentations in case studies, their teamwork in project-based learning, and their sense of social responsibility and professionalism in project reports will all be included in the final grades through clear scoring rules, such as the Rubric scale, guiding students to continuously focus on quality improvement throughout the learning process.

Introduce multi-faceted evaluation and require students to submit learning reflection logs after the course, highlighting their gains and thoughts in terms of values and professional qualities; In team projects, introduce peer assessment within the group to examine students' sense of fairness, teamwork spirit and responsibility; For qualities that are difficult to quantify, such as "communication skills", "ethical judgment", and "social responsibility", develop specific, graded evaluation scales to make the evaluation based on evidence and the results more objective and fair.

Through the evaluation reform, we have ultimately formed a complete teaching closed loop of "goal guidance - content support- method implementation - evaluation feedback", driving the continuous improvement and spiral ascent of ideological and political teaching quality in engineering management major courses.

4 REFORM PRACTICE: A TEACHING CASE OF THE PROJECT MANAGEMENT COURSE

To put the aforementioned reform path into practice, we took Project Management, a core course of the National First-Class Undergraduate major construction point, as a pilot and carried out in-depth reform practice, achieving remarkable results.

4.1 Case Introduction

This reform selects the chapter "Project Risk Management" from "Project Management" as a typical teaching unit. This unit is inherently rich in ideological and political elements such as engineering ethics, social responsibility, systems thinking and a sense of responsibility, and is an ideal carrier for achieving the "value-knowledge-ability" trinity goal.

4.2 Teaching Implementation Process

We designed a three-stage coherent teaching activity of "pre-class - in-class - after-class" with the theme of "Ethical Decision-making Throughout the Process of Engineering Safety Risks".

1) Pre-class online reflection: Through the online teaching platform, two carefully prepared "risk ethics cases" were pushed to the students. One of them is a virtual scenario of "a major unknown geological hazard discovered in a metro construction section"; The second is the real industry event of the choice between cost and reliability of safety limit devices for tower cranes. Students are required to preview the basics of risk management and do preliminary thinking and online comments under the case.

2) In-class offline internalization (core 90 minutes)

Context introduction (10 minutes): The teacher begins with a warning video of a major engineering safety accident, introduces the core issue of "responsibility behind risk", and clarifies the ethical dimension of this class.

Group Inquiry and debate (35 minutes) where students engage in group discussions based on pre-class cases. For

"subway construction hazard", each group is required to play different roles, simulate an emergency plan decision-making meeting, and debate the trade-off between "the huge cost of halting work for investigation" and "the potential catastrophic consequences of unknown risks". Teachers guide students to think about the bottom line of professional ethics and social responsibility behind the decisions.

Intensive instruction and value elevation (15 minutes): The teacher returns the group's points of contention to risk management theories (such as the risk matrix, response strategies), and emphasizes that the most effective risk response is prevention, and the most fundamental prevention stems from reverence for life and a high sense of responsibility, internalizing "safety first" from a slogan into a professional belief.

3) Post-class action transfer: Students are required to submit a risk management and ethical responsibility assessment report in groups. The report requires not only technical analysis using methods such as WBS-RBS, but also a dedicated chapter on the ethical principles upheld by the group in the simulated decision-making, as well as the "excess" responsibilities and costs that the group is willing to undertake to ensure the safety of the project. To achieve the elevation from knowledge understanding to value recognition and then to behavior orientation.

4.3 Teaching Resource Support

To support the implementation of this case, we have developed a series of resources "Project Management Ideological and Political Case Collection (Risk and Ethics Special Topic)" contains more than 10 detailed positive and negative cases and teaching guides. Videos, decision-making simulation interfaces and other interactive sections are embedded in traditional PPTS. An online thematic website that gathers relevant engineering accident investigation reports, industry norms and expert interview videos for students to expand their learning. This case fully demonstrates how ideological and political education can be silently integrated into the entire process of professional teaching through a closely linked teaching design, achieving the educational effect of "nourishing things imperceptibly".

5 ANALYSIS OF THE EFFECTIVENESS OF TEACHING REFORM

5.1 Student Feedback Analysis

Through course evaluation, interviews and learning reflections, students gave high praise to the integration of ideological and political education in courses with professional teaching. In the teaching evaluation, students generally believed that the curriculum was highly consistent with the core knowledge and skills of engineering management, and the embedding of ideological and political elements strengthened professional ethics, social responsibility and the concept of the rule of law; In the interviews, students responded positively to teaching links such as "role-playing" and "situational cases", indicating that they could understand the importance of national needs and industry ethics in real engineering situations; The learning reflection reports submitted show that students' worldviews, professional identities and values have improved significantly, and they are willing to hold themselves to the standards of integrity, dedication and innovation.

5.2 Teaching Observation and Supervision Evaluation

The teaching supervision group attended classes many times and generally gave good feedback. The classroom atmosphere is lively, students are active, and teachers' guidance in case analysis, group discussions, and cross-disciplinary collaboration is significantly enhanced; The integration of information technology tools (such as BIM-related materials, digital drawing and scheduling software) into teaching has enhanced the authenticity and timeliness of teaching. The supervisory opinion also pointed out that the integration of ideological and political elements with professional knowledge is more natural, and the curriculum design emphasizes the whole process of education, but there is still room for improvement in the depth of school-enterprise collaboration and resource connection.

5.3 Analysis of Student Learning Outcomes

In terms of learning outcomes, students' project reports emphasize professional competence, risk identification, communication and collaboration, and ethical decision-making ability; In course exams, the average score for scenario analysis questions increased significantly by about 15-20 percentage points compared to before the reform, indicating that students have been able to apply knowledge comprehensively to solve practical engineering problems in complex situations. Through situational assessments of key points such as cost, schedule, quality and safety, students have a more solid grasp of the core points, and their interdisciplinary collaboration and problem-solving abilities have been significantly enhanced.

5.4 Radiating and Promoting the Results of Reform

The reform results have created replicable demonstration effects within departments, established a case library of ideological and political education in courses, a digital textbook and a system of high-quality online courses, and constructed a multi-dimensional assessment mechanism of "1+1+1", significantly improving the efficiency of resource

utilization. In the intercollegiate exchanges, other institutions showed great interest in the design of ideological and political education in this course and were willing to carry out resource sharing and co-construction to promote the in-depth advancement of industry-education integration. In the future, we will continue to expand the paths of school-enterprise collaborative education, enrich teaching scenarios and case libraries, and promote the continuous improvement of the effect of all-staff, all-process and all-aspect education.

6 CONCLUSIONS AND REFLECTIONS

6.1 Main Experiences and Conclusions of the Reform

The success of this reform stems from three levels of systematic elements. First, system design and consensus building, with the goal of "whole-process education", integrating ideological and political education into the core of the major to form a unified teaching objective and evaluation orientation; Second, methodological innovation and information support: The establishment of a course-based ideological and political case library, digital teaching materials, and comprehensive assessment tools based on context has enhanced the authenticity of teaching and the comparability of assessment; Third, deep industry-education collaboration and inter-school exchanges, school-enterprise co-construction and cross-institutional resource sharing have been continuously expanded to form replicable demonstration points.

6.2 Problems and Directions for Improvement

Reform still faces challenges such as high teacher input intensity, high time cost, difficulty in quantifying some evaluation indicators, and the lack of timeliness and depth of resource connection between schools and enterprises also restricts further improvement. The next step will be to continue to improve the teacher training and incentive mechanism, build a unified data collection and analysis platform, and form a more stable school-enterprise collaboration and resource sharing mechanism; Optimize the scenario case library and assessment tools to make the indicators more operational and comparable; Drive continuous iteration at the curriculum group level, set goals, evaluate and provide feedback in stages, and improve the efficiency of resource matching and the sustainability of educational outcomes.

6.3 Implications for Teaching in Similar Specialties

This reform is highly transferable. It can be replicated in terms of positioning, building curriculum clusters, establishing contextualized teaching and case libraries, creating stable school-enterprise collaboration and resource sharing mechanisms, establishing multi-dimensional quantifiable evaluation systems, and improving teacher development support. When other majors draw on this, they should design scenarios and cases based on their own disciplinary characteristics to ensure the natural integration of ideological and political elements with professional knowledge; Establish a sustainable resource co-construction and evaluation mechanism to form a long-term mechanism for collaborative education both within and outside the school, in order to enhance the vocational orientation and social contribution of interdisciplinary teaching.

COMPETING INTERESTS

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