

Research on the Strategies and Practice of Ideological and Political Collaborative Education in PLC Technology Course

Wei Zhang

School of Mechanical Engineering, University of Shanghai for Science and Technology, Yangpu, Shanghai, 200093, China

ABSTRACT

The increasing demand for high-quality engineering and technical talents in the new era has outpaced the ability of traditional educational models to meet the diverse needs of society. Specifically, higher education faces the challenge of simultaneously enhancing students' social responsibility, innovative spirit, and professional ethics, while fostering their technical abilities. This paper focuses on the "PLC Technology" course and explores strategies and practices for integrating ideological and political collaborative education into the curriculum. The paper proposes a model of ideological and political collaborative education for the "PLC Technology" course, emphasizing the integration of professional knowledge and ideological education in teaching. The goal is to cultivate high-quality electrical engineering professionals with both moral integrity and technical skills. The paper discusses implementation strategies for ideological and political collaborative education, incorporating innovative teaching methods such as case analysis, project-driven approaches, and interactive teaching to enhance students' social responsibility, teamwork, and professional ethics. Implementing these strategies integrates societal values into students' technical skill development, enhancing their awareness of social responsibility and national sentiment.

KEYWORDS

PLC Technology; Collaborative education; Ideological and political education; Teaching reform; Electrical engineering

1 Introduction

The primary task of higher education is to cultivate builders and successors for socialist construction, which is achieved primarily through curriculum education. Curriculum education is the core method of talent cultivation, imparting both theoretical knowledge and practical skills. It is a collaborative process that integrates course content learning with ideological and political education. As educational models transform, mere skill training can no longer meet the new era's demand for high-quality talent. The concept of collaborative education has emerged to cultivate high-level engineering and technical talent with both moral integrity and professional competence. This concept emphasizes the integration of ideological and political education with professional course teaching, encouraging students to enhance their social responsibility and professional ethics while acquiring specialized knowledge, thus achieving dual improvements in both professional capabilities and ideological qualities^[1]. The "PLC Technology" course, as a key part of the electrical engineering program, not only enhances students' professional abilities and innovative thinking but also serves as a crucial platform for ideological and political education^[2]. The course is grounded in the strategic context of national intelligent manufacturing and automation development, closely aligning with industry technological needs. In addition to imparting PLC-related technologies, the course integrates elements of ideological and political education, including modern manufacturing concepts, social responsibility, and patriotism, into the teaching content. By integrating ideological and political education with professional technology, the "PLC Technology" course helps students recognize the pivotal role of automation technology in national industrial upgrading, fostering their sense of responsibility and mission toward society.

2 Strategies for ideological and political collaborative education based on the "PLC Technology" course

In the "PLC Technology" course, ideological and political education should focus on enhancing social responsibility, fostering a sense of mission, cultivating innovative awareness and engineering ethics, promoting collectivism and teamwork, and inspiring patriotism and national pride. Integrating these ideological and political concepts with professional technical content helps students develop correct values and social responsibility, improve professional ethics, and understand how their technical skills can contribute to national and societal development^[3].

2.1 Formulation of ideological and political education teaching strategies

In the "PLC Technology" course, ideological and political education should be seamlessly integrated with professional content to foster correct values and social responsibility in students throughout their technical learning. Exploring the

application of PLC technology in electrical engineering helps students understand that learning technology is not just for solving engineering problems, but also for serving society, advancing technological progress, and contributing to social development. Educators should align national strategic needs with the development of the electrical industry, guiding students to recognize the connection between their technical abilities and national and societal progress, thus stimulating their sense of social responsibility and patriotism. In this process, the teacher's role extends beyond transmitting technical knowledge to guiding ideological and political education and fostering students' innovative thinking. The "PLC Technology" course should integrate ideological and political education goals into its content design. The core of ideological and political education is to enhance students' ideological literacy while also focusing on cultivating professional ethics. In the "PLC Technology" course, educators guide students to understand the application of electrical engineering in various industries, emphasizing the ethical responsibilities of technicians in innovation and technology implementation. Through the design of ideological and political education, teachers integrate social responsibility and professional ethics into their teaching plans, helping students recognize the societal value of technology. In each chapter, various teaching methods help students develop both technical skills and awareness of social responsibility and professional ethics. This encourages students to integrate their technical abilities with social responsibility in their future careers, contributing to societal progress and development. The teaching plan for ideological and political education in the "PLC Technology" course is shown in Table 1.

Table 1 Teaching plan for ideological and political education in the "PLC Technology" course

Chapter	Ideological and Political Education Content	Ideological and Political Education Methods	Ideological and Political Objectives
Composition, working principle, use, and application methods of traditional relay and contactor control components	1.Application of relays in power systems and mechanical equipment fields 2.Introduction to the role and contributions of traditional relays in the past	1.Organize the viewing of videos related to traditional relays 2.Integrate knowledge of relays and contactors with ideological and political education	Help students understand the ethics, responsibility, and social value behind the technology
Composition principle, circuit analysis, and basic methods of system design for control circuits	1.Consider engineering ethics and social responsibility in control circuit design 2.Discuss the applications of control circuit design in the modernization process	Analyze and discuss cases of intelligent manufacturing development, guiding students to broadly think about technical and ethical issues in China's industrial production	Help students understand how control circuits contribute to the country's modernization efforts
Basic components, working principle, and characteristics of PLC	Application of PLC in industrial control systems and other fields	1.Watch educational videos related to PLC and the revitalization of the country through science and education 2.Discuss the widespread application of PLC in various industries in China	1.Strengthen students' belief in serving the country 2.Foster a strong interest in learning PLC
PLC circuit design methods and programming methods	PLC programming methods require innovative thinking. Consider how to improve existing PLC programs to enhance efficiency, reduce energy consumption, or minimize resource waste	1.Check news to see the application of PLC in industrial processes 2.Discuss the crucial role of PLC technology in achieving a modern, powerful nation and a technological powerhouse	Strengthen students' awareness of industrial safety, understand the importance of safety design in modern industrial systems, and cultivate students' sense of social responsibility and collectivism. Inspire students' passion for engineering technology and their recognition of the continuous strengthening of national technological power, motivating them to participate in technological innovation, industrial upgrading, and contribute to industrial modernization and national security
Basic PLC application system design	How modern industrial processes improve existing PLC system designs to enhance the safety of industrial production	Introduce some cutting-edge PLC technologies, and discuss the rapid iteration of PLC in industrial processes, allowing students to experience the advancement of technology	

2.2 Implementation of ideological and political education collaborative strategy

Implementing the ideological and political education collaborative strategy in the "PLC Technology" course requires diverse teaching methods and in-depth practical integration. Teachers should employ heuristic, discussion-based, project-driven, and other diverse teaching methods, focusing on developing students' ideological awareness through solving real engineering problems^[4]. Case analysis helps students understand the social value of PLC technology in electrical engineering, learn to adhere to ethical principles in technological applications, and develop a deep sense of social responsibility during technical learning.

Ideological and political education in the "PLC Technology" course should extend beyond classroom teaching to include extracurricular activities. Teachers can organize visits to power companies, industrial automation facilities, and other projects, enabling students to experience the practical application of PLC technology in electrical engineering. This enables students to integrate the professional knowledge learned in class with social responsibility. These extracurricular activities enhance students' practical social skills and help them understand the social impact of technology, thus strengthening their sense of mission and responsibility.

As a practical course, the "PLC Technology" course design should emphasize the integration of theory and practice. Teachers can design experimental projects related to social responsibility to enhance students' practical skills while reinforcing their sense of social duty. In the experimental teaching process, students deepen their understanding of PLC technology through hands-on problem-solving and gain insight into the social and environmental impact of technology, fostering recognition of its social value and ethical responsibility.

Implementing ideological and political education requires teachers to take a leading role in the teaching process. Teachers should consistently prioritize ideological and political education and integrate it into professional teaching. By practicing professional ethics and social responsibility, teachers set an example for students, guiding them to integrate professional knowledge with social responsibility in their future careers, ensuring their comprehensive development. The ultimate goal is to cultivate high-quality electrical engineering professionals who are skilled and possess social responsibility and an innovative spirit. In this process, both teachers and students collaborate to achieve the goals of ideological and political education and develop outstanding talents.

3 Implementation of ideological and political education collaborative strategy in the "PLC Technology" course

3.1 "From Outside to Inside" constructing ideological and political education in the course

(1) Incorporating ideological and political case studies into teaching

In teaching the "PLC Technology" course, teachers should analyze the knowledge system and explore the connections between PLC technology, control systems, national industrial policies, energy optimization, and responsibilities in electrical engineering. For example, by highlighting China's achievements in PLC technology, demonstrating its applications in electrical control systems, and analyzing how these technologies support national development goals such as energy transition and emissions reduction. During teaching, teachers can use real-world case studies to help students reflect on the critical role of PLC technology in industrial control systems and other fields, guiding them to understand how these technologies align with national strategies, environmental protection, and social responsibility. This approach helps students master technical skills while subtly shaping their values and enhancing their overall literacy.

(2) Modern teaching technologies to assist in teaching

Modern teaching technologies should be fully integrated into the "PLC Technology" course to improve classroom interactivity and learning outcomes. By introducing interactive topics like "How can PLC technology optimize industrial control?" or "What is the key role of PLC in industrial control?", students can participate in real-time discussions. When explaining PLC programming methods and motor control system design, teachers should incorporate the latest advancements in PLC technology across industrial control, electrical control, and other fields, helping students understand the close relationship between technological knowledge and national development goals. By using heuristic, discussion-based, and project-driven methods, teachers can assess students' learning needs and adjust teaching plans accordingly, ensuring that students deeply understand professional knowledge while enhancing their sense of social responsibility and awareness of national electrical engineering development goals.

(3) Teacher demonstration to promote teaching

The teacher's behavior and attitude in the "PLC Technology" course serve as a model. Teachers should exhibit a passionate and rigorous attitude toward electrical engineering technology. For example, when explaining the application of PLC technology in industrial and electrical control, teachers should emphasize its importance in future industrial development, stimulating students' interest and motivation to learn. Teachers should also showcase their deep understanding and ongoing pursuit of electrical engineering through personal efforts and academic achievements,

encouraging students to align their ideals with national technological goals and fostering a strong sense of responsibility and mission. The teacher's role as a role model ignites students' enthusiasm for professional knowledge and helps them establish proper professional ethics and social responsibility, fostering a sense of service to the country and society.

Throughout the teaching process, the course integrates ideological and political education with professional learning by sharing industry case studies, linking training knowledge with ideological concepts, and reinforcing students' professional ethics and social responsibility. This achieves the "From Outside to Inside" goal of ideological and political education.

3.2 "Spiral Progression" refining ideological and political education elements

The PLC application technology course adopts a "Spiral Progression" approach to more effectively integrate ideological and political education, fostering the continuous internalization and gradual enhancement of students' ideological awareness. Through a layered approach, students progressively deepen their understanding of ideological education while mastering professional skills.

The specific ideological and political entry points for the five key course contents are as follows: the basic principles of PLC, control circuit composition, PLC components, PLC circuit design and programming methods, and basic PLC application system design. These ideological entry points integrate concepts such as national pride and the ideal of a powerful nation, meticulousness and professionalism, teamwork and standardization awareness, striving for excellence and quality consciousness, the spirit of model workers and continuous improvement, and a sense of responsibility and practical spirit.

In the foundational stage, the development of PLC industrial control is introduced, integrating key concepts of national development strategies and core socialist values. At the start of the course, the role of PLC in intelligent manufacturing is explained, emphasizing the importance of innovation and responsibility. As the course progresses, practical case studies are introduced, such as PLC applications in environmental protection and energy-saving projects, where students design control solutions aligned with sustainable development goals. During this phase, students integrate the ideological and political content learned in the foundational stage with professional knowledge, engaging in deeper reflection and practice. In the advanced stages, by organizing students to participate in real industrial automation projects, their understanding of how automation technology supports social development is deepened. By the end of the course, students can independently integrate ideological education with professional technology, transitioning from knowledge to action.

Through the "Spiral Progression" strategy, ideological and political elements are effectively integrated into the "PLC Technology" course, encouraging students to gradually internalize and develop ideological awareness as they learn knowledge and skills. This strategy fosters a continuous, progressive learning and thinking pattern. It combines ideological and political education with professional teaching, enhancing students' skills while strengthening their sense of social responsibility and moral values.

3.3 "Six Rings and Three Practices" teaching model

Work tasks are designed based on the real work process of designing, installing, and debugging factory control systems, ensuring that the teaching content is closely aligned with practical applications. The teaching process is student-centered, following a "three-stage" flow: pre-class skill exploration, in-class skill refinement, and post-class skill expansion. This method helps students systematically master skills at each stage while ensuring a deep understanding of knowledge and improvement in application abilities.

To enhance teaching effectiveness, the course adopts the "Six Rings and Three Practices" model, focusing on six key stages: skill exploration, demonstration and imitation, guidance and consolidation, inspiration and application, review and summary, and skill improvement. The model emphasizes three practices: strengthening the foundation, skill demonstration, and comprehensive skill integration. The teaching method includes group discussions, action learning, and task-driven approaches, blending various teaching methods and learning strategies. This promotes the integration of skills and applications, ultimately achieving the teaching goals.

4 Results

This article examines the effective integration of ideological and political education into the "PLC Technology" course, proposing strategies to enhance students' professional skills and social responsibility through collaborative approaches. By combining PLC technology with national industrial policies, social responsibility, patriotism, and other ideological elements, knowledge dissemination, skill development, and value shaping are seamlessly integrated, cultivating students'

sense of social responsibility, innovation, and professional ethics. Through diverse teaching methods, such as case analysis, interactive teaching, and real-world case integration, students' electrical engineering skills are strengthened, deepening their sense of responsibility and mission toward social and national development. Additionally, by applying the "spiral progression" and "six rings and three practices" teaching models, ideological and political education is effectively integrated, progressively enhancing students' ideological qualities in alignment with their professional development.

About the Author

Wei Zhang, Doctor of Engineering, Lecturer, Power System Operation and Control under Peak Carbon Achievement and Carbon Neutrality Objectives.

References

- [1] HU Yan, HUANG Panpan. Exploration on Ideological and Political Teaching Reform of Engineering Specialty Courses. *Die & Mould Manufacture*, 2025,25(01):79-81.
- [2] Galego D. The Anti-Homophobia Bill (PLC 122) in Brazil: Conspiracies and conflicts between the constitution and the bible. *Politics and Governance*, 2022, 10(4): 216-228.
- [3] Yu Y. On the ideological and political education of college students in the new media era[J]. *Open Journal of Social Sciences*, 2022, 10(1): 1-14.
- [4] Chen T. Research on the dilemma and breakthrough path of ideological and political education in colleges and universities in the era of big data. *Journal of Higher Education Research*, 2022, 3(2): 203-206.