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Modular Design and Practice of Ideological and Political Education Content in Power Electronics Technology Courses

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ABSTRACT
This paper focuses on the Power Electronics Technology course, systematically exploring the development pathways and implementation strategies for its ideological and political education modular teaching. It first clarifies the educational philosophy of integrating ideological and political education into engineering education and the structural advantages of modular design. Subsequently, it analyzes the practical bottlenecks in this course regarding the depth of integration of ideological and political elements, the effectiveness of teaching implementation vehicles, and the appropriateness of evaluation mechanisms. To address these issues, this study proposes constructing a modular system across multiple core dimensions: designing module content that intrinsically couples professional knowledge with value elements; implementing a project-driven approach using real-world case studies; and establishing a diversified evaluation framework that integrates knowledge/skill acquisition with value cultivation.

KEYWORDS
Power electronics technology; Ideological and political education in coursework; Content modularization

1 Introduction

China's higher education is undergoing a profound transformation, shifting its fundamental mission toward fostering virtue and cultivating talent while aligning its development orientation with serving the nation's primary strategic needs. Against this backdrop, ideological and political education in coursework—as a comprehensive educational reform initiative—has been defined as transcending the model of confining ideological education to specific courses. Instead, it aims to organically integrate value guidance into all course instruction and talent cultivation. This transformative imperative holds particular urgency for engineering education. Core courses like Power Electronics Technology directly impact national energy security, cutting-edge high-end equipment manufacturing, and the implementation of the "dual carbon" strategy. Graduates from these programs will become core developers of future frontier technologies and key executors of national strategic will and the backbone of China's modern industrial system. Therefore, while deeply imparting their complex professional knowledge systems, systematically cultivating students' sense of national pride, engineering ethics awareness, scientific inquiry spirit, and meticulous craftsmanship possesses undeniable strategic value.

2 Theoretical implications of modular teaching for ideological and political education in power electronics courses

2.1 The educational logic of integrating ideological and political education into engineering instruction

The core educational logic of integrating ideological and political education into deep-level teaching within engineering disciplines lies in facilitating a structural shift in its underlying paradigm. This transcends the framework of mere knowledge transmission, moving toward a holistic paradigm that guides value recognition. Its core objective is cultivating outstanding, versatile technical professionals with profound specialized expertise, robust engineering capabilities, and noble intrinsic character. Implementing ideological and political education within the engineering discipline does not imply diminishing the depth of specialized technical knowledge exploration [1]. Instead, it entails systematically uncovering and revealing the underlying ideological threads and core value orientations embedded within the evolutionary trajectory of science and technology, breakthroughs in core principles, and innovative engineering practice cases. This value guidance can be concretized. For instance, when studying the dynamic evolution of power electronics circuit topologies, students grasp the creative drive inspired by humanity's eternal pursuit of efficient energy utilization; When delving into breakthrough cases of domestic substitution for semiconductor power devices, they internalize the arduous struggles and outstanding achievements crystallized in the national strategy for advancing self-reliance in critical core technologies; Through real-world operational workflows in power conversion system design projects, they develop an ethical awareness of responsibility toward ensuring the safe, stable operation, environmental characteristics, and pursuit of ultimate efficiency throughout a product's entire lifecycle; When participating in evaluations and discussions of new energy grid-connection technology solutions, they deepen their perception of the

profound mission of serving the national strategic goals of carbon neutrality and peak carbon emissions.

2.2 Advantages of modular design in unifying knowledge transmission and value guidance

Modular design is a mature methodology for managing complexity, centered on deconstructing an entire system into foundational units with relatively straightforward functions, standardized interfaces, and high combinatorial flexibility. Applying this structural thinking to the pedagogical architecture of course-based ideological and political education demonstrates outstanding synergy in advancing professional knowledge systems and guiding students' value orientations. This advantage manifests in the following dimensions: First, the modular architecture facilitates the deep integration and evidence-based embedding of value elements. Unlike generalized content collage approaches, it advocates identifying and anchoring optimal alignment points for value guidance along the core trajectory of professional knowledge development—namely, key value nodes that resonate profoundly with the knowledge's essence, developmental history, or application challenges. Second, modular design significantly enhances the adaptive resilience of instructional organization and content delivery. Educators can dynamically select, organize, and call upon relatively independent teaching modules; dynamically reconstruct and optimize content; or update specific units in real-time. This is based on the cognitive levels of different learners, actual course progress and schedule changes, and hot trends in the technical field. Furthermore, the modular approach promotes the standardized development of teaching resources and fosters a shared ecosystem. Each core teaching module can be structured as a standardized instructional unit containing clearly defined learning objectives, multidimensional supporting case resources, specific implementation pathways, and quantifiable outcome assessment criteria.

2.3 Building a modular teaching system as a systematic pathway to deepen curriculum-based ideological and political education

To effectively transform course-based ideological and political education from fragmented attempts and isolated experiences into a comprehensive educational practice mechanism covering all teaching content, underpinned by a rigorous systemic foundation, and capable of stable, sustainable operation, it is imperative to establish a unified modular teaching organization system. This system represents an evolution in teaching methodologies and signifies a systematic update to the underlying logical framework and overall structural configuration of course design [2]. Developing a modularized, holistic framework fundamentally means that the operationalization of ideological and political education within courses no longer relies excessively on individual instructors' spontaneous intellectual output and ad-hoc creativity. Instead, it is systematically grounded in the highly structured analysis and organization of the intrinsic systemic relationships within the power electronics technology knowledge map. This foundation is further enriched by deeply dissecting and integrating the representative value elements embedded within its historical development. The value of establishing such a holistic system architecture lies primarily in ensuring that value-shaping integration achieves comprehensive coverage rather than isolated, partial manifestations. It is rooted in the intrinsic characteristics of the knowledge domain itself, thereby avoiding becoming an isolated add-on. It facilitates the maintenance of a highly coherent and orderly unfolding of the overall form, preventing it from fragmenting into disjointed, scattered states .

3 Current challenges in ideological and political education practices for power electronics technology courses

3.1 Rigid and superficial integration of ideological elements with professional knowledge

The core contradiction in current ideological and political education practices for power electronics technology courses manifests as a structural disconnect between value-oriented content and the professional teaching system. This is characterized explicitly by rigid integration patterns involving mechanical collage and symbolic attachment. Some educators exhibit cognitive biases, superficially interpreting the essence of ideological and political education in courses. Typical manifestations include awkwardly inserting macro-policy interpretations before explaining technical principles, or abruptly appending abstract moral lectures after complex circuit topology analyses. Such practices fail to foster genuine synergy between the two and disrupt the continuity of professional knowledge acquisition. This alienates ideological and political elements into isolated components detached from the core curriculum narrative. The root cause lies in the superficial and imprecise exploration of inherent spiritual and value resources within the discipline, failing to recognize the intrinsic resonance mechanism linking scientific laws, technological evolution logic, and technical ethics. This form of value expression, devoid of deep intrinsic connections, It is difficult to evoke emotional resonance and rational identification among learners, Worse, it may induce passive resistance, ultimately leading to the systemic erosion of the

core function of curriculum-based ideological and political education: achieving holistic education goals.

3.2 Lack of effective implementation vehicles hinders value guidance

The effective internalization of values and the shaping of professional character cannot be achieved solely through one-way transmission of classroom knowledge. They fundamentally require embodied practical experiences within authentic contexts. The current power electronics course organization remains predominantly teacher-dominated and centered on one-way lectures, with insufficient methodological innovation. Within this framework, ideological education inevitably simplifies into a linear model of proclamation and reception, severely lacking practical vehicles that drive student engagement in technical decision-making, deep immersion in engineering ethical dilemmas, and autonomous construction of value judgments [3]. Although students' cognitive systems receive value-based information, the absence of project-based learning and immersive technical ethics discussions to support theoretical transformation prevents abstract values from permeating deep cognitive schemas. Consequently, these values cannot evolve into spontaneous behavioral paradigms for navigating complex engineering ecosystems. This absence of a practical vehicle ultimately leaves the effectiveness of ideological and political education suspended at the theoretical level.

3.3 Teaching evaluation systems prioritizing knowledge over competencies undermines comprehensive educational outcomes

The design of evaluation mechanisms profoundly shapes the goal orientation and implementation logic of teaching processes. Within the current course evaluation framework, final exam scores persist as the core—or even sole—basis for assessing competency. This system suffers from a fundamental institutional flaw: it entirely neglects the assessment mechanisms for the core competencies that course-based ideological and political education aims to cultivate. These include the conviction to serve the nation through industry, engineering ethics, decision-making capabilities, a sense of responsibility for technological innovation, and interdisciplinary collaboration skills. Students' value perceptions shaped by evaluation feedback suggest that acquiring technical knowledge constitutes the entirety of academic objectives, while growth in spiritual literacy remains excluded from performance assessments. This structural imbalance prevents the scientific measurement of a course's synergistic effectiveness in knowledge transmission, competency development, and values cultivation. Still, it more profoundly undermines the fundamental motivation for students to actively construct value cognition within course-based ideological and political education activities.

4 Pathways for constructing modularized ideological and political education in power electronics courses

4.1 Establishing a value guidance module system deeply coupled with professional knowledge points

The key to organically integrating ideological and political elements with professional knowledge lies in systematically organizing and constructing value guidance modules intrinsically linked to the core knowledge framework of the course. Teaching module design should follow the logic of knowledge-derived value, ensuring each ideological theme naturally extends from specific technical content. For instance, when teaching the principles of key power semiconductor devices, link them to the challenges and breakthroughs in technological self-reliance to help students grasp the significance of scientific and technological independence. When analyzing the evolution of power conversion circuit topologies, emphasize the innovative process of engineers breaking through fixed mindsets to cultivate critical thinking [4]. When exploring renewable energy grid-connection technologies, closely integrate them with national energy transition strategies to deepen students' awareness of sustainable development responsibilities. Such instructional design aims to make value guidance emerge as a natural byproduct of professional knowledge transmission, effectively resolving the awkward integration of ideological content with specialized teaching.

4.2 Innovating diversified teaching practices driven by project cases

To facilitate the transformation of value recognition into action, we must transcend traditional lecture modes and construct a practice-oriented teaching platform driven by project cases. The focus is on creating engineering task scenarios that simultaneously address technical challenges and foster value recognition. For instance, organizing students to design and debug typical power conversion devices collaboratively allows them to practice engineering ethics—balancing cost-benefit, adhering to equipment safety standards, and ensuring system reliability—while solving real technical problems. Alternatively, analyzing case studies of major national projects enables students to understand the social responsibility dimension of engineering decisions while exploring technical solutions. This practical approach

transforms abstract values like craftsmanship and teamwork into concrete operational standards through experiential learning, bridging the gap between value recognition and engineering practice.

4.3 Establishing a process-based comprehensive evaluation system integrating knowledge competence and value literacy

Developing a scientific evaluation system is crucial for ensuring educational effectiveness. Traditional assessment models focused solely on knowledge acquisition should be reformed to establish a diversified evaluation framework spanning the teaching process [5]. Core measures include: significantly increasing the weight of process-based evaluations such as classroom discussion performance, project practice records, and case analysis reports; designing composite evaluation rubrics that integrate technical indicators with competency development dimensions—for example, assessing circuit design evaluations based on technical solution rationality, cost control awareness, and safety standard considerations; and implementing learning portfolio systems to track the evolution of students' value perceptions. This evaluation mechanism clearly signals to students that while mastering professional technical skills is essential, engineering ethics, innovative thinking, and teamwork are equally vital, forming the core competency spectrum of future outstanding engineers .

5 Conclusion

Deepening course-based ideological and political education in advanced engineering courses, such as power electronics, requires systematically reconstructing teaching models. The modular approach proposed herein integrates value elements—including serving the nation through science and technology and engineering ethics—into the instruction of key technologies. It drives the transformation of ethical decision-making capabilities through project-based practices like renewable energy grid integration, while establishing an evaluation system encompassing technical proficiency, sustainability assessment, and team collaboration. This synergistic framework—combining knowledge transmission, practice reinforcement, and evaluation-driven guidance—cultivates versatile engineers proficient in complex system design while upholding ethical standards, thereby continuously supplying core talent for strategic emerging industries.

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