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ENHANCING DIALECTICAL THINKING SKILLS FOR STUDENTS MAJORING IN POWER SYSTEMS THROUGH THE APPLICATION OF THE MATERIALIST METHODOLOGY OF MARXISM-LENINISM

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ABSTRACT
Dialectical thinking is an important competency that enables students majoring in power systems to analyze and solve technical problems in a scientific and effective manner. The dialectical materialist methodology of Marxism-Leninism provides a solid theoretical foundation for developing this mode of thinking. This paper analyzes the role of dialectical materialist methodology in enhancing dialectical thinking skills for students in the power systems major, and proposes teaching and learning methods to help students fully develop their dialectical thinking abilities. Accordingly, the paper offers specific solutions for applying this methodology in teaching, contributing to improving the quality of power engineering education in the current context.

Keywords:
Dialectical thinking, dialectical materialist methodology, Marxism-Leninism, power systems, technical education, thinking skills, higher education.

1. INTRODUCTION

In the context of the rapid development of the Fourth Industrial Revolution, technical fields—especially power systems—are facing increasing demands for continuous technological innovation, as well as significant challenges in enhancing workers' thinking and problem-solving skills. Power systems play a crucial role in supplying energy and controlling industrial production processes, and are undergoing major transformations with the emergence of new technologies such as automation, artificial intelligence (AI), and the Internet of Things (IoT). These technologies require electrical engineers not only to have solid technical knowledge but also to possess critical thinking, creativity, and particularly, dialectical thinking.
Dialectical thinking is an essential mode of thought that enables individuals to perceive, analyze, and solve problems in life and work in a profound and comprehensive manner. For students majoring in power systems, dialectical thinking not only helps them better understand the fundamental principles of power systems but also enhances their ability to recognize the complex interrelationships among system components. This, in turn, allows them to propose optimal and innovative technical solutions. Therefore, strengthening dialectical thinking skills among power systems students is an urgent requirement in teaching and training activities.
The dialectical materialist methodology of Marxism-Leninism provides a solid theoretical foundation for developing dialectical thinking. This methodology emphasizes the movement and development of objects and phenomena through their mutual relationships and interactions. As a result, it helps students understand the dynamic nature of technical systems and develop appropriate technical solutions for specific situations. In the field of power systems, applying this methodology not only deepens students' understanding of how power systems operate but also enhances their ability to analyze, evaluate, and resolve technical contradictions encountered in the design, operation, and maintenance of such systems.
However, enhancing dialectical thinking skills in power systems students is not a simple task. Achieving this goal requires a transformation in teaching and learning methods, including reforming curricula, adopting innovative teaching approaches, and creating practical learning environments where students can apply knowledge to solve real-world technical problems. This paper focuses on analyzing the role of dialectical materialist methodology in enhancing dialectical thinking skills for power systems students. It also proposes specific solutions for integrating this methodology into teaching, thereby contributing to improving the quality of education in the electrical engineering sector in the current context. Through the study and application of dialectical materialist methodology in the teaching process, the paper also identifies key factors in developing dialectical thinking among students. This contributes to producing power systems engineers who can meet the increasingly high demands of the industry and effectively solve practical problems. This is one of the crucial tasks of higher education today, where change and innovation are decisive factors for the sustainable development of technical fields, especially the power systems sector.

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2. DIALECTICAL MATERIALIST METHODOLOGY AND ITS IMPORTANCE FOR POWER SYSTEM STUDENTS

2.1. Fundamental Principles of the Dialectical Materialist Methodology

The dialectical materialist methodology is a system of principles and laws aimed at understanding and solving problems that arise during the development of nature, society, and human thought. Primarily developed by philosophers Karl Marx and Friedrich Engels, this methodology has become an essential theoretical foundation for studying and analyzing phenomena and objects in the objective world. When applied to the technical field—particularly in power systems—these principles offer a comprehensive and in-depth perspective on the movement, development, and interrelationships of elements within complex systems. Below are the fundamental principles of the dialectical materialist methodology:

Firstly, the principle of matter determining consciousness

This principle asserts that matter is the origin and foundation of all existence and phenomena, including human consciousness. Consciousness is not an independent or spontaneous factor; it is formed and developed based on the material conditions of the objective world. This means that in any process of cognition and problem-solving, humans must always base their understanding on the material reality of objects and phenomena.

In power systems, this principle can be applied to the design and operation of electrical systems. Dialectical thinking requires students not only to rely on theory but also to analyze the material aspects of the electrical system—such as structure, components, and properties of electrical devices, as well as physical elements like voltage, current, and power. Understanding the material nature of power systems helps students gain a more holistic view in analyzing, evaluating, and improving these systems.

Secondly, the principle of dialectical interrelation among things and phenomena

According to dialectical materialism, all things and phenomena in nature and society are interconnected and mutually influential. Nothing exists in isolation; everything is linked and interacts within a comprehensive system. This principle emphasizes the transformation between elements and how changes in one can influence and lead to changes in others.

In power systems, this principle is evident in the relationships among system components—such as generators, converters, motors, control devices, sensors, and the power grid. A clear understanding of the dialectical relationships between these components allows students to identify interdependencies, optimize performance, and minimize risks in the design and operation of power systems.

Thirdly, the principle of constant movement and development

Dialectical materialism maintains that all things and phenomena are in constant motion and development. This movement may be progressive (development) or regressive (degeneration), but it always trends toward adaptation and improvement in new conditions. Everything evolves from lower to higher forms, from simplicity to complexity.

In the field of power systems, this ongoing development is reflected in the integration of new technologies into the design and operation of electrical systems. Technologies such as automation, artificial intelligence (AI), the Internet of Things (IoT), and smart grids are driving significant advancements in the industry. Power system students must understand this principle to stay proactive in adopting and applying new technologies, ensuring the continuous development of power systems.

Fourthly, the principle of dialectical contradiction and development through struggle

One of the key principles of dialectical materialist methodology is the principle of contradiction. It states that all things and phenomena contain internal contradictions, and these contradictions are the driving force behind movement and development. Contradictions may occur within a single object or between different objects, and resolving them is the source of progress.

In power systems, dialectical contradictions often emerge in technical scenarios, such as between efficiency and cost, between energy-saving demands and system quality, or between system stability and flexibility. Understanding and resolving these contradictions empowers students to develop creative solutions, enhancing their analytical and problem-solving skills in real-world applications.

Fifthly, the principle of universality and specificity

This principle emphasizes that while phenomena may share common features, each also possesses unique characteristics shaped by specific conditions and contexts. While the dialectical materialist methodology identifies general principles, researchers and engineers must also pay attention to the particularities of each system and situation to develop optimal solutions.

In the power systems field, this principle is clearly reflected in the design and implementation of power system projects. Each system has its own operational conditions, technical requirements, and environmental factors. Electrical engineers must apply general principles flexibly to address specific challenges in different practical scenarios.

2.2. The Importance of the Dialectical Materialist Methodology in the Power Systems Field

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In the context of the Fourth Industrial Revolution and the rapid advancement of emerging technologies, the power systems industry is increasingly facing challenges and demands for innovation, creativity, and precision in design and operation. The dialectical materialist methodology, with its fundamental principles, plays a crucial role in helping engineers, researchers, and students in the field of power systems enhance their thinking capabilities, solve complex problems, and develop intelligent and efficient electrical systems.

Applying dialectical materialist methodology is not merely about conveying theoretical knowledge; it is also a critical tool for the development and improvement of power systems—especially when confronted with fast-paced technological changes and shifting market demands. Below are key aspects that illustrate the importance of this methodology in the power systems field:

2.2.1. Enhancing analytical and problem-solving capabilities

The dialectical materialist methodology is a powerful tool for developing analytical thinking. Through the principle of dialectical relationships among elements, power systems students can recognize the interactions and mutual influences among components in an electrical system. These relationships may include interactions between devices, physical factors during electricity transmission, or even between technological, economic, and social aspects involved in the development and maintenance of power systems.

For example, in power system design and operation, engineers must understand the relationships among power, voltage, and current to ensure system stability. By applying dialectical methodology, engineers can identify interrelated factors and find optimal solutions, especially in complex scenarios such as system control and protection. This strengthens their ability to solve technical problems in intricate systems while optimizing performance and minimizing failures.

2.2.2. Improving forecasting and system development abilities

Forecasting changes and developments in electrical systems is a critical aspect of the power systems field—especially as new technologies like smart grids, the Internet of Things (IoT), and artificial intelligence (AI) are increasingly adopted. The dialectical materialist methodology, through its principle of constant motion and development, provides a systematic approach that enables engineers to identify industry trends, make accurate predictions, and propose effective development strategies.

For instance, in modern power systems, managing remote devices via sensors and intelligent control systems requires a mindset that can track and adapt to technological changes. This methodology helps students understand the dynamic nature of technology, allowing them to design systems that are flexible and responsive to evolving requirements.

2.2.3. Developing systems thinking and dialectical thinking

Power systems are inherently complex, composed of numerous interrelated elements. The dialectical materialist methodology equips students and engineers with systems thinking, enabling them to perceive phenomena in terms of interconnected relationships rather than isolated components.

Dialectical thinking, grounded in the principle of contradiction, teaches students that each system element not only has a distinct function but is also tightly linked to other components. Addressing contradictions within systems—such as mismatches between supply and demand, or between performance and cost in energy projects—is essential for maintaining system stability and efficiency. Teaching this methodology helps students analyze such complex problems and propose suitable solutions.

2.2.4. Fostering innovative solutions in system design and operation

Dialectical materialism goes beyond recognizing reality—it also fosters creativity, which is crucial in the power systems sector. Applying cutting-edge technologies such as automation, power electronics, and artificial intelligence requires a creative mindset to overcome new challenges in design and operation.

Through the principle of constant development and motion, the methodology encourages students to not only apply existing knowledge but also invent new solutions. For example, in designing smart power systems, engineers can use dialectical thinking to optimize automated control processes, ensuring flexibility and efficiency in energy distribution and consumption—ultimately enhancing system performance and reducing energy losses.

2.2.5. Promoting sustainability and system efficiency

Integrating dialectical materialist methodology into teaching and research in the power systems field improves not only technical efficiency but also long-term sustainability. In the face of climate change, environmental protection, and energy-saving requirements, this methodology helps students understand how material developments in systems impact both the environment and society.

Power systems students trained in this methodology can develop more efficient and environmentally friendly system designs and operations. Solutions involving renewable energy, smart grids, and effective electricity management can boost performance while preserving natural resources and minimizing pollution. These approaches contribute to creating sustainable power systems in the long term.

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3. APPLICATION OF DIALECTICAL MATERIALIST METHODOLOGY IN TEACHING POWER SYSTEMS ENGINEERING

In the field of power systems engineering, teaching is not limited to conveying technical knowledge; it must also equip students with a scientific methodology that enables them to develop critical thinking, creativity, and the ability to solve complex problems. The dialectical materialist methodology—with its core principles such as interrelation, constant development, and contradiction—provides students with a powerful tool for addressing technical issues and fosters systems thinking and creativity in the design and operation of electrical systems. Below are several ways this methodology can be applied in teaching power systems engineering.

3.1. Solving Technical Problems in Power Systems

Technical issues frequently arise in the power systems field, requiring students not only to understand theoretical concepts but also to apply them effectively in practice. The dialectical materialist methodology encourages students to analyze technical problems from multiple perspectives, rather than in isolation. This is especially important in power systems, where each element (such as voltage, current, resistance, and power) is closely interconnected and cannot be considered independently.

For example, when designing and operating an electrical circuit, students must understand the mutual influence between factors like voltage, current, power, and resistance. If they analyze these elements separately without understanding their interactions, it will be difficult to find optimal solutions—leading to system failures, energy waste, or unstable operation.

This methodology requires students to examine these factors as part of a comprehensive system, where each component is interrelated and mutually influential. This enables students to optimize circuit designs, reduce energy consumption, and improve the durability of electrical systems. At the same time, they learn to anticipate possible failures during system operation and develop suitable preventive measures.

3.2. Systems Thinking and Interrelationships Between Components

The power systems field comprises complex systems with tightly interconnected technical components. From energy sources, transmission and distribution devices, to end-user electrical equipment—all elements are highly interdependent. Dialectical materialist methodology helps students develop systems thinking, encouraging them to view each component not as an isolated entity but as a part of an integrated whole, where every element influences and interacts with others.

For instance, in an industrial power system, fluctuations in load demand from electrical devices directly impact the power supply capacity. Without understanding the interconnections between system components, students may struggle to design systems that meet usage needs while ensuring safety and efficiency. The dialectical materialist methodology teaches students that changes in one part of the system can ripple throughout the entire network. This insight leads to more balanced and effective adjustments and optimization strategies. Recognizing and analyzing these interrelationships not only deepens students' understanding of how power systems operate, but also builds a solid foundation for optimizing system design, operation, maintenance, and performance in real-world applications.

3.3. Developing the Ability to Analyze Contradictions and Solve Problems

Contradiction is an inevitable element in any system, including power systems. The dialectical materialist methodology enables students to identify and resolve contradictions within electrical systems, leading to more efficient and sustainable technical solutions. In this field, contradictions may arise in various forms—from physical inconsistencies in power transmission to gaps between theory and practical application during system operation.

A typical example is the discrepancy between theoretical and actual power capacity in a transmission system. While theoretical capacity may be calculated precisely using physical formulas, real-world factors such as power losses, system inefficiencies, or fluctuating operating conditions often lead to significant differences. Dialectical materialist methodology helps students recognize these contradictions and apply dialectical thinking to analyze and resolve them effectively.

For example, when encountering a contradiction between voltage and current in a circuit, this methodology prompts students to investigate the root causes and propose practical solutions—such as adjusting circuit parameters or reconfiguring circuit layouts to meet operational requirements.

Identifying and addressing such contradictions not only ensures stable system performance but also fosters innovation in the design, improvement, and maintenance of electrical systems. In this way, students develop a scientific mindset capable of tackling complex technical challenges in the power systems field.

3.4. Fostering Creative and Innovative Thinking in Power System Design

One of the key factors in improving training quality in power systems engineering is developing creative and innovative thinking. The dialectical materialist methodology, through its principles of constant development and contradiction, encourages students to go beyond applying existing solutions to create novel and improved system designs that meet real-world demands.

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As the energy sector continues to evolve rapidly with the integration of new technologies—such as smart grids, automation, artificial intelligence (AI), and the Internet of Things (IoT)—this methodology equips students with not only strong theoretical knowledge but also the skills to apply it creatively. It encourages students to explore beyond traditional approaches and discover more effective, modern solutions that address the demands of Industry 4.0.

Students are guided to think not only about how to solve a problem, but how to do so in a more efficient, flexible, and sustainable way. This creative application of dialectical materialism helps bridge the gap between theory and innovation, preparing students to lead technological advancements in power systems design and operation.

4. TEACHING AND LEARNING METHODS THAT ENCOURAGE DIALECTICAL THINKING

To maximize the development of dialectical thinking skills in students of power systems engineering, teaching methods must go beyond theoretical instruction and be closely tied to practical realities. These methods should encourage students to cultivate analytical abilities, logical reasoning, and problem-solving skills in real-world industrial environments. Therefore, teaching in the power systems field must be flexible, creative, and incorporate approaches that stimulate student creativity and critical thinking. Below are several effective teaching methods to encourage dialectical thinking in students.

4.1. Teaching Through Real-World Case Studies

One essential method to stimulate dialectical thinking is using real-world case studies in teaching. These scenarios allow students to engage with technical problems in specific working environments, helping them not only master theoretical knowledge but also practice applying that knowledge in real-life situations.

Teaching through real-world cases helps students develop dialectical analytical thinking by requiring them to consider technical issues not just from a theoretical standpoint but also in relation to real-world factors like environmental conditions, human elements, and dynamic technical parameters during the operation of power systems. For instance, instructors might present scenarios involving fault handling in a transmission system or designing an optimized circuit for energy-consuming equipment in a factory.

In solving such real-world cases, students must go beyond applying technical formulas—they must confront contradictions and practical challenges, developing dialectical thinking to find suitable solutions. This method not only deepens students' understanding of theoretical concepts but also encourages them to explore creative and practical technical solutions.

4.2. Group Discussions and Problem Solving

Group discussions and collaborative problem-solving are powerful tools for fostering dialectical thinking in power systems education. Encouraging students to work in teams enhances their ability to exchange ideas, analyze issues from multiple angles, and solve technical problems collaboratively. Since teamwork is essential for engineers in the real world, cultivating this skill during university is crucial.

Through group discussions, students learn how to analyze technical issues, identify factors that affect the power system, and propose suitable solutions. A technical problem can often be approached from many perspectives, with each group member offering a unique viewpoint. This diversity promotes critical thinking and collaborative problem-solving. As they encounter conflicting approaches within the group, students develop the ability to recognize and resolve contradictions using dialectical methods.

Moreover, group work teaches students to perform under pressure, collaborate effectively, and contribute to collective goals—essential skills in the professional engineering environment. Instructors can assign complex technical challenges that require teamwork to solve, which enhances students' analytical abilities and inspires creativity in addressing engineering problems.

4.3. Using Simulation Software in Teaching

Simulation software is a vital tool in power systems education, helping students better understand electrical circuits, systems, and the factors that influence their performance. These tools allow students to practice analysis and optimization without the need for direct experimentation on physical equipment, saving both time and resources.

Simulation software enables students to replicate the operation of electrical systems in a virtual environment, helping them identify problems and test technical solutions. For example, students can simulate circuits under varying voltage levels, power loads, or fault conditions during transmission. This helps them understand interactions between system components and recognize potential causes of operational failures.

By using simulation tools, students can also practice optimizing circuit designs, experiment with new solutions, and assess their effectiveness before applying them in real settings. These tools not only familiarize students with modern technologies but also promote dialectical thinking through comparative analysis and solution optimization in virtual environments.

4.4. Active Learning and Project-Based Learning

Active learning and project-based approaches are highly effective in encouraging dialectical thinking. In these methods, students are not passive recipients of knowledge; instead, they are encouraged to take initiative, conduct research, and

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participate in real-world technical projects. Engaging in such projects helps students develop independent thinking, analyze issues from various perspectives, and learn to solve practical problems.

Project-based learning also builds students' teamwork, communication, and project management skills—all of which are vital in the power systems industry. Projects might involve designing an electrical system for an industrial facility, optimizing circuits for energy consumption, or researching and proposing improvements to existing systems. Throughout these projects, students encounter technical problems, contradictions, and challenges, prompting them to apply dialectical thinking to find optimal solutions.

4.5. Encouraging Self-Study and Research

In addition to direct instruction, promoting self-study and research is critical for developing dialectical thinking. Students should be encouraged to explore technical issues independently, stay informed on new technological trends, and apply their knowledge to solve real-world problems. Self-study fosters critical thinking and motivates students to explore and innovate on their own.

CONCLUSION

Fostering dialectical thinking in power systems engineering students is a vital task in training future electrical engineers. Applying the dialectical materialist methodology from Marxism-Leninism in teaching helps students develop critical, analytical thinking and solve technical problems scientifically and effectively. Flexible and creative teaching methods allow students to apply dialectical thinking to real-world challenges, preparing them to meet the increasingly complex demands of the electrical engineering field in the modern technological era.

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