Received: 06 Jun. 2025 | Revised: 15 Jun. 2025 | Accepted: 03 Jul. 2025 | Published online: 25 Jul. 2025

RESEARCH ARTICLE

Contemporary Education and Teaching Research
2025, Vol. 6 (7)288-294
DOI: 10.61360/BoniCETR252018530706

Research on Innovation of Practice Teaching Model of "Five-Education and Three-Integration" in Thermal Power Plant Engineering Program

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Abstract: With the continuous improvement of talent cultivation quality in higher vocational education, the teaching of thermal power plant engineering urgently needs to innovate teaching models to meet the development demands of the new era. The "Five-Education Integration" teaching model not only promotes the comprehensive development of students' quality but also effectively enhances the integration of theory and practice, driving the dual improvement of teaching quality and talent cultivation quality. Therefore, this paper, based on the practice teaching concept of "Five-Education and Three-Integration," systematically analyzes the innovative value of this model in the teaching of thermal power plant engineering. It also explores specific innovative pathways from four aspects: constructing a multi-dimensional education system, deepening the integration of moral education practice courses, innovating practical teaching carriers, and improving the evaluation system, aiming to provide beneficial references for the reform of higher vocational professional teaching.

Keywords: thermal power plant engineering program, Five-Education and Three-Integration, practical value, innovative pathways

1. Introduction

As an important applied major in higher vocational colleges, the thermal power plant engineering program bears the significant responsibility of cultivating technical and skilled talents for the power industry. With the profound transformation of social and industrial structures, traditional teaching models can no longer meet the new era's demands for the comprehensive development of students in morality, intelligence, physical fitness, aesthetic appreciation, and labor skills. Against this backdrop, the implementation of the "Five-Education Integration" practice teaching model has become a crucial direction for the current reform of professional teaching. This model emphasizes the organic integration of the five educational goals: moral, intellectual, physical, aesthetic, labor education and the deep integration of moral education practice courses with professional teaching, the combination of theoretical and practical teaching, and the sharing of resources through school-enterprise cooperation. By systematically constructing this model, it is possible to effectively enhance students' overall quality and professional abilities, thereby promoting the development of higher vocational education towards higher quality.

2. The Innovative Value of the "Five-Education and Three-Integration" Practice Teaching Model in the Teaching of Thermal Power Plant Engineering Program

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2.1 It is conducive to promoting the comprehensive development of students' quality

The "Five-Education and Three-Integration" teaching model emphasizes the organic integration of moral, intellectual, physical, aesthetic, and labor education, and is committed to promoting the comprehensive and coordinated development of students in these five aspects. In the teaching practice of the thermal power plant engineering program, this model not only focuses on imparting solid professional knowledge and skills but also actively integrates moral education into the curriculum. By strengthening professional ethics education and the cultivation of a sense of responsibility, it enhances students' patriotism and professional integrity. At the same time, in line with the characteristics of the major, it pays attention to students' physical exercise and organizes labor practice and physical training to improve their physical fitness and practical skills, and enhance their ability to adapt to high-intensity working environments. By introducing aesthetic education elements, such as the teaching of engineering aesthetics, energy-saving and environmental protection concepts, and the display of technological innovation, it stimulates students' aesthetic awareness and innovative thinking, enabling them to perceive the value of beauty in their technical studies and cultivate comprehensive aesthetic literacy. The labor education component, through school-enterprise cooperation and practical training base practice, brings students into the real power plant operating environment. It allows them to experience the value of labor in specific work, temper their ability to solve practical problems, and foster their team spirit (Li, 2025). Overall, the "Five-Education Integration" model achieves the organic combination of knowledge transmission with ideological education, physical exercise, aesthetic cultivation, and labor practice. It not only improves students' professional abilities but also promotes the development of their professional ethics, sense of responsibility, and innovative spirit. This lays a solid foundation for cultivating high-quality technical and skilled talents with comprehensive quality that meet the requirements of the new era in the thermal power plant engineering program.

2.2 It is conducive to promoting the deep integration of theory and practice and improving practical ability

The core concept of the "Three-Integrations" in the "Five-Education Integration" practice teaching model, namely the integration of moral education practice courses into professional teaching, the deep integration of theoretical and practical teaching, and the organic integration of school-enterprise cooperation and teaching resources, has greatly promoted the innovative development of the teaching of thermal power plant engineering program. In the specific implementation process, this model skillfully integrates the content of ideological and moral education into professional course teaching. It enables students to deeply understand industry responsibility, professional ethics, and social mission while learning professional theoretical knowledge, thereby enhancing their moral identification and value leadership. Theoretical teaching is no longer a simple knowledge transmission but is closely integrated with practical teaching. Through various forms such as experimental operations, simulation, and on-site training, it achieves the application and verification of theoretical knowledge in practice, effectively improving students' hands-on ability and comprehensive practical level. At the same time, relying on the school-enterprise cooperation platform, teaching resources are highly integrated with enterprise production resources. Students are able to enter the actual working environment of power plants, participate in real projects and production processes, and experience the working atmosphere and technical challenges of the production site. Through the joint construction of training bases and research projects by schools and enterprises, students not only deepen their understanding of professional knowledge but also cultivate their ability to analyze and solve problems, and enhance their professional quality to meet job requirements (Chen, 2025). The "Five-Education Integration" model breaks through the barriers of the traditional teaching separation of

theory and practice through the "Three-Integrations" path. It promotes the comprehensive innovation of the content, methods, and environment of professional courses, significantly improving students' practical operation ability and comprehensive quality, and laying a solid foundation for cultivating high-level technical and skilled talents in the thermal power plant engineering program.

2.3 It is conducive to promoting the innovation of teaching models and the improvement of teaching quality

The core of the "Five-Education and Three-Integration" practice teaching model lies in promoting a profound transformation of teaching concepts and methods, supported by diversified teaching methods and a sound evaluation mechanism, to achieve a comprehensive improvement in teaching quality and in-depth cultivation of students' core literacy. On the one hand, the model fully employs project-based learning, integrating typical engineering cases of thermal power engineering in power plants with actual production problems. Students actively explore and collaborate in teams throughout the entire process from requirement analysis to solution design and implementation verification. This not only deepens their understanding of professional knowledge but also hones their project management and communication skills (Zhu, 2025). On the other hand, case teaching is adopted, using typical fault handling and equipment optimization examples from the industry. Teachers guide students to learn analytical methods and problem-solving approaches through scenario reenactment and problem diagnosis, which enhances the relevance and effectiveness of learning. Meanwhile, virtual simulation technology is introduced to build a digital power plant operation environment. Students conduct parameter tuning, fault simulation, and emergency drills on the virtual platform, transforming abstract theoretical knowledge into visualized operational experiences. This effectively improves students' practical skills and safety awareness. The integration of industry and education is also deepened in this model. Schools and enterprises jointly develop courses, with enterprise engineers serving as guest mentors in teaching design and evaluation. Students complete technical solutions and experimental reports in real projects, further bridging the gap between theory and job competencies. In terms of the evaluation system, the "Five-Education and Three-Integration" model breaks through the traditional single final exam evaluation and constructs a multi-dimensional evaluation system that runs through the entire teaching process. This includes regular assignments, lab reports, project presentations, peer evaluations within teams, and teacher assessments. It incorporates the effectiveness of moral education, learning attitudes, practical abilities, and innovative achievements into the evaluation criteria, achieving comprehensive tracking and dynamic feedback of students' overall quality. By promptly consolidating various evaluation data, teachers can accurately identify weak links in the teaching process and make targeted adjustments to continuously optimize course content and teaching methods.

3. Innovative Pathways for the "Five-Education and Three-Integration" Practice Teaching Model in Thermal Power Plant Engineering Program

3.1 Constructing a multi-dimensional education system to integrate the five-education goals

In the teaching reform of the thermal power plant engineering program, constructing a multi-dimensional education system that covers moral, intellectual, physical, aesthetic, and labor education is not only the core essence of the "Five-Education Integration" practice teaching model but also the essential path to cultivating high-quality technical and skilled talents. In terms of moral education, professional ethics and moral education should be organically integrated into each professional course. Through forms such as special lectures, case analysis, and class discussions, students are guided to deeply understand the development history, social responsibility, and national energy strategy of the power industry, thereby establishing a professional value view of

"dedication, innovation, and responsibility" (Sun, 2025). In the realm of intellectual education, in addition to imparting systematic thermodynamic basic theories, equipment operation principles, and fault diagnosis methods, it is crucial to employ diverse teaching methods, such as flipped classrooms, simulation software, and project-driven learning. These methods stimulate students' abilities to think actively, explore problems, and learn independently, cultivating their comprehensive quality to quickly acquire and apply knowledge under complex engineering conditions. Regarding physical education, physical training programs that are combined with professional skills should be designed in accordance with the characteristics of power plant positions. For example, heat endurance training that simulates high-temperature operations and emergency rescue skill drills not only improves students' physical fitness but also enhances their team collaboration and emergency response capabilities. In the area of aesthetic education, organizing visits to power plant areas with regional cultural characteristics, listening to experts' explanations on the integration of engineering aesthetics and environmental art, or involving students in energy-saving renovation design competitions can combine technology with aesthetics, fostering their aesthetic taste and innovative consciousness. In terms of labor education, full use should be made of on- and off-campus training bases and school-enterprise cooperation platforms to allow students to participate in production practices such as equipment installation, commissioning, maintenance, and optimization and renovation. This enables them to experience the value of labor and team division of labor firsthand, tempering their practical skills and problem-solving abilities. Through the organic integration of the above five educational goals, not only is a high degree of integration between professional teaching content and educational goals achieved, but also a multi-dimensional and full-process growth space is provided for students. This enables them to master professional skills while possessing good professional ethics, strong learning motivation, healthy physique, refined aesthetic taste, and a solid work attitude, thereby laying a solid foundation for the thermal power plant engineering program to cultivate new-era power engineering technical talents with a sense of responsibility, innovative spirit, and comprehensive quality (Hu, 2023).

3.2 Deepening the "three-integrations" concept to promote the integration of moral education practice courses with professional teaching

Deepening the "Three-Integrations" concept is a key pathway to achieving a deep integration of moral education in professional courses and professional teaching in the thermal power engineering in power plants major. In teaching practice, closely focusing on the core knowledge points of the major, ideological and moral education content should be organically embedded into the curriculum system to ensure that the transmission of professional knowledge and moral education practice courses are advanced in tandem, achieving the dual goals of knowledge transmission and value guidance. Specifically, when teaching technical content such as thermodynamic principles and boiler operation and maintenance, teachers should not only explain the technical details but also integrate the background of industry development, national energy strategy, and the concept of ecological civilization construction. This helps students understand the social significance and sense of responsibility behind professional knowledge, thereby enhancing their professional identity and mission. At the same time, the integration of theoretical and practical teaching should be deepened, with a focus on the design of experimental and training links, prompting students to understand the practical application value of theoretical knowledge through specific operations. For example, through practical activities such as the simulation operation of the thermal system in the laboratory, boiler maintenance training, and on-site equipment maintenance, students can experience the complexity and technical requirements of power plant operations firsthand, enhancing their practical and emergency response capabilities. With the help

of school-enterprise cooperation platforms, students have the opportunity to enter real power plant production sites to participate in corporate technological transformation and production management, experiencing the direct contribution of professional technology to economic development and social progress. In this process, moral education is not limited to classroom lectures but permeates practical experiences and the cultivation of professional quality, helping students establish a correct worldview, outlook on life, and values (Lou, 2020). The deepening of the "Three-Integrations" concept is also reflected in the innovation of teaching methods. Methods such as case teaching, problem-oriented learning, and project-driven learning are used to cleverly integrate moral education content into the process of solving professional problems. This stimulates students' autonomous learning and critical thinking, promoting their comprehensive development. Overall, deepening the "Three-Integrations" concept to promote the integration of moral education courses with professional teaching achieves an organic unity of knowledge education and value guidance. It not only enhances students' professional skills but also cultivates their sense of responsibility and social commitment, laying a solid foundation for the thermal power plant engineering program to cultivate new-era technical talents with high professional ethics and innovation capabilities.

3.3 Innovating practical teaching vehicles to strengthen industry-education integration and school-enterprise cooperation

Innovating practical teaching vehicles and strengthening industry-education integration and school-enterprise cooperation are crucial measures to enhance the quality of talent cultivation in the thermal power plant engineering program. By actively exploring new models of in-depth school-enterprise cooperation, professional teaching has transitioned from traditional classrooms to a combination of industry, academia, and research, establishing a multi-level and multi-channel practical teaching platform. On the one hand, relying on the rich resource advantages of power plant enterprises, schools and enterprises jointly construct on- and off-campus training bases, creating a training environment that covers multiple aspects such as equipment operation, maintenance, and energy efficiency management. This allows students to complete various technical tasks in a simulated real production environment, effectively improving their hands-on practical abilities and engineering application levels (Wang, 2020). On the other hand, leveraging modern information technology, virtual simulation laboratories are built. Through techniques such as 3D simulation and virtual reality, digital power plant operation scenarios are constructed. Students can repeatedly perform equipment tuning, fault diagnosis, and emergency drills in a virtual environment, which not only ensures safety but also greatly enhances the intuitiveness and experiential quality of teaching. Meanwhile, schools and enterprises can closely collaborate to jointly develop course content and practical projects, inviting enterprise technical backbone personnel to participate in course design and teaching guidance. This builds a platform for shared faculty and co-built resources, ensuring that teaching content is closely aligned with industry frontiers and job requirements. By jointly conducting technical competitions, research projects, and production internships, students can exercise their ability to solve complex problems in real engineering projects and cultivate their innovative awareness and team spirit. In terms of practical teaching mechanisms, the "learning and application integration, work-study alternation" teaching model is actively promoted. Students are encouraged to promptly apply what they have learned in class to production practice and deepen their theoretical understanding through feedback from practice, achieving a virtuous interaction between theory and practice. Innovating practical teaching vehicles and strengthening industry-education integration and school-enterprise cooperation not only broadens students' practical channels and learning spaces but also promotes the optimal allocation of teaching resources and the

comprehensive improvement of educational quality. This lays a solid foundation for cultivating high-quality power engineering technical talents with solid skills and innovation capabilities that meet the demands of the modern power industry.

3.4 Improving the evaluation system to promote teaching quality assurance and feedback

Improving the evaluation system is a key link in ensuring the high-quality development of the "Five-Education and Three-Integration" practice teaching model in the thermal power plant engineering program. A scientific and rational teaching evaluation system not only focuses on students' mastery of professional knowledge and skill levels but also comprehensively covers multi-dimensional assessments of ideological and moral performance, labor skills, innovation capabilities, and overall quality, achieving dynamic monitoring and precise guidance for students' comprehensive growth. This evaluation system emphasizes process evaluation, which runs through the entire teaching process. Through diverse means such as phased practical assessments, laboratory operation scoring, and project presentations, it can keep track of students' learning progress and ability enhancement in real-time. This effectively avoids the limitations of the traditional "summative" examination's single evaluation, enhancing the timeliness and relevance of the evaluation. It is also necessary to focus on comprehensive quality evaluation, incorporating students' ideological and moral performance as an important indicator to assess their professional ethics, sense of responsibility, and team spirit, ensuring that students are not only technically proficient but also possess good professional qualities and social responsibility. Labor skills and innovative spirit are also important aspects of the evaluation. Through students' actual performance in training and school-enterprise cooperation projects, as well as the display of innovative achievements, their hands-on practical abilities and innovative awareness are fully reflected. In terms of evaluation methods, a diversified evaluation approach is adopted, combining teacher-student mutual evaluation, peer evaluation, self-evaluation, and enterprise mentor evaluation to form a three-dimensional, multi-angle evaluation system. This promotes effective communication and interaction between teachers and students, and between schools and enterprises, achieving a virtuous cycle of evaluation feedback. The evaluation results not only serve as an important basis for students' grades but also become a crucial reference for adjusting teaching content, improving teaching methods, and optimizing course design, driving the continuous improvement of teaching quality. By constructing a scientific, dynamic, and comprehensive evaluation mechanism, it ensures that the "Five-Education Integration" teaching model achieves balanced development in ideological and political education, professional ability cultivation, labor practice, and innovation ability shaping. This effectively promotes the comprehensive improvement of students' overall quality and personalized growth, providing a solid guarantee for the steady improvement of talent cultivation quality in the thermal power plant engineering program and driving the continuous innovation and high-quality development of professional teaching (Zhao, 2020).

Conclusion

To sum up, the innovation of the "Five-Education and Three-Integration" practice teaching model in the thermal power plant engineering program has not only propelled the transformation of professional teaching concepts and methods but also provided strong support for the cultivation of students' overall quality and vocational abilities. By constructing a multi-dimensional education system, deepening the integration of moral education courses, innovating practical teaching vehicles, and improving the evaluation system, this model has achieved a high degree of integration between teaching content and educational goals, and promoted the deep integration of theory and practice. Moving forward, it is imperative to continue advancing in-depth school-enterprise cooperation, enhance resource sharing and collaborative education,

and constantly refine the teaching evaluation mechanism. This will ensure the effective implementation and continuous optimization of the "Five-Education and Three-Integration" model in professional teaching, thereby assisting the thermal power plant engineering program in cultivating more high-quality technical and skilled talents that meet societal demands.

Conflict of interest

The author declares he has no conflicts of interest in this work.

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How to Cite: Li, M. (2025). Research on Innovation of Practice Teaching Model of "Five-Education and Three-Integration" in Thermal Power Plant Engineering Program. *Contemporary Education and Teaching Research*, *06*(7), 288-294. https://doi.org/10.61360/BoniCETR252018530706