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Construction of Ideological and Political Education for Master's Degree Students in Materials Engineering Based on the Course of Polymer Reaction Engineering

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Abstract

Professional degree postgraduates in China will undertake important responsi-bilities in the future social development. Their ideological and political qualities are directly related to the core tasks of national construction. Therefore, ideo-logical and political construction in professional degree postgraduate courses is particularly important. This project systematically explores ideological and po-litical elements in the curriculum, updates teaching content, designs teaching methods, adopts reasonable teaching means, and adjusts the evaluation and as-sessment mechanism to integrate ideological and political education into the curriculum teaching system. The project takes professional courses as the carri-er, combines ideological and political education with professional knowledge, and supplements practical teaching links to present the abstract professional knowledge in a more understandable way. This not only enables ideological and political education to run through the entire postgraduate education but also makes it easier for postgraduates to understand and accept, allowing them to correctly recognize the era's responsibilities and historical missions they shoulder and integrate their personal ideals and pursuits into the cause of the country and the nation, thereby achieving the goal of shaping their correct out-look on life, values, and morality. The implementation of this project is of great significance in stimulating the enthusiasm of professional degree master's stu-dents for active learning, enhancing their innovative consciousness, improving their ability to solve practical engineering problems, expanding their language expression, teamwork and other abilities, and enhancing their scientific and humanistic qualities.

Keywords

Professional degree postgraduates; Master's Degree; Political qualities

1. Introduction

Against the backdrop of deepening education reform in China, comprehensively

promoting the construction of ideological and political education in the curriculum has become the core strategy for implementing the fundamental task of cultivating morality and talents. As an important support for strategic emerging industries such as high-end manufacturing, new energy, and biomedicine in China, the quality of master's degree training in materials engineering directly affects the country's ability for independent scientific and technological innovation and the process of industrial upgrading. Polymer Reaction Engineering, as a core course in Materials Engineering, not only undertakes the imparting of professional knowledge such as polymerization reaction principles and process design, but also shoulders the important mission of shaping the scientific spirit, patriotism, and social responsibility of graduate students. However, the current situation of the relative separation between professional education and ideological and political education in traditional teaching models is difficult to meet the training needs of high-quality engineering talents in the new era. In this context, carrying out ideological and political reforms in the course of Polymer Reaction Engineering, promoting the deep integration of professional knowledge and ideological and political education, has become an inevitable choice for cultivating high-level engineering talents with both morality and talent.

2. Main research content and implementation process

2.1 Three dimensional construction of curriculum ideological and political teaching objectives, exploring ideological and political elements

2.1.1 Design concept of "two main lines+four major logics+several ideological and political elements"

The project team deeply analyzed the knowledge system of the course "Polymer Reaction Engineering" and innovatively proposed a teaching design concept of "two main lines+four major logics+several ideological and political elements". Taking "knowledge and skills" and "ideological and political elements" as the main thread, running through the entire teaching process, achieving a dual track parallel of professional education and ideological and political education. At the same time, based on the four major logics of knowledge, history, practice, and demand, we will deeply explore ideological and political elements:

Knowledge logic: Extracting scientific thinking methods from professional knowledge such as polymerization reaction kinetics and reactor design, cultivating students' rigorous and pragmatic scientific spirit. For example, when explaining the mechanism of free radical polymerization reactions, the long exploration process of scientists in determining reaction rate constants is introduced to guide students to understand the importance of "bold assumptions and careful verification" in scientific research.

Historical logic: Sort out the development of polymer science and tell the story of Chinese scientists' struggle to break through foreign technology blockades and

achieve the localization of key polymer materials. Provide a detailed introduction to the arduous process of China's independent research and development of polycarbonate (PC) materials, demonstrating the patriotism and innovative responsibility of scientific researchers, and enhancing students' sense of national pride and mission.

Practical logic: Through the analysis of typical engineering cases, strengthen students' quality awareness and responsibility. When explaining the case of optimizing the production process of polymer materials, guide students to deeply consider the important impact of product quality on consumer safety and environmental sustainability, and cultivate their sense of social responsibility.

Requirement logic: Closely integrating national strategic needs with social development reality, inspiring students' determination to serve the country. Taking the "dual carbon" goal as the starting point, introduce research and development cases of biodegradable polymer materials, and encourage students to combine their personal research direction with the national green development needs.

2.1.2 Multi dimensional classroom achieves integration of ideological and political education

Through multidimensional classroom forms such as classroom lectures, group discussions, case analysis, and on-site visits, ideological and political elements are organically integrated into the teaching process. In the classroom teaching process, teachers carefully design teaching language and cases to naturally convey ideological and political concepts; In group discussions, speculative topics such as "Ethical controversies in the development of polymer new materials" were set up to guide students in practicing socialist core values; When conducting case analysis, select typical engineering cases from both domestic and international sources to enable students to gain insights into technological ethics while solving practical problems; Organize students to visit polymer material production enterprises, personally experience the craftsmanship and dedication spirit of engineers, and achieve the coordination and unity of explicit and implicit education. In actual teaching, group discussions and case studies should be conducted no less than 8 times per semester, and enterprise visits should be organized 2-3 times to ensure the depth and breadth of integration of ideological and political education.

2.2 Reform of Teaching Content to Assist in the Implementation of Ideological and Political Education in Curriculum

2.2.1 Tilt towards actual engineering and strengthen application orientation

The course content closely revolves around the needs of engineering practice, selecting typical cases such as the preparation of lithium battery separator materials and industrial production of water-based coatings, systematically disassembling key technologies such as polymerization process optimization and reactor selection. Through the teaching process of "theoretical explanation case analysis scheme de-

sign", guide students to apply professional knowledge to solve practical problems. At the same time, incorporating ideological and political elements such as "green manufacturing" and "safety production" into case analysis can cultivate students' awareness of engineering ethics and environmental protection concepts. For example, in the case teaching of lithium battery separator material preparation, not only is the process technology explained, but also the energy consumption control and waste disposal in the production process are deeply explored, guiding students to establish a sustainable development concept.

2.2.2 Keep up with the forefront of disciplines and highlight professional characteristics

The teaching team regularly tracks the scientific research trends in the polymer field, and timely integrates new polymerization methods (such as click chemistry, active polymerization), intelligent polymer materials (such as shape memory polymers, stimulus response hydrogels) and other cutting-edge achievements into the teaching content. At the same time, based on the team's research expertise in the reaction preparation of functional polymer materials, special topics such as "Design and Synthesis of Biomedical Polymer Materials" will be established to showcase the advantages of this discipline in serving the field of life and health, stimulate students' research interest and innovation enthusiasm, and enhance their professional identity. The proportion of teaching content updated every semester reaches 20% -30% to ensure the timeliness and progressiveness of teaching content.

2.2.3 Introduce enterprise resources and deepen the integration of industry and education

Invite senior engineers from enterprises to enter the classroom and conduct special lectures and technical sharing, covering practical issues such as process improvement, quality control, and equipment maintenance in polymer production. At the same time, record videos of the company's production site to assist teaching through online platforms. For example, when explaining the amplification process of polymerization reactions, a video of a company's entire process from laboratory trials to industrial production is played. Engineers use the video to explain the key technical difficulties and solutions in the amplification process, helping students understand the meaning of "learning to apply". The implementation of these methods has significantly improved students' learning motivation.

2.3 Reform of teaching methods to promote personality development

2.3.1 Task cooperation self-learning method cultivates team spirit

Decompose the course content into comprehensive learning tasks such as "designing a polymerization process scheme for new biodegradable plastics", and students will conduct literature research, scheme design, and result reporting in groups. In the process of cooperation, through clear division of labor, regular communication, and mutual evaluation, students' teamwork spirit and communication coordination

ability are cultivated, while guiding them to establish a sense of the overall situation, learn to contribute and take responsibility. According to a questionnaire survey, 90% of students believe that group cooperative learning has effectively improved their teamwork skills.

2.3.2 Task driven teaching method to stimulate learning potential

Set challenging engineering tasks such as "solving the problem of unstable product quality in the production of a certain polymer", requiring students to independently collect data, analyze the causes of the problem, and propose solutions. Teachers guide students to actively explore knowledge, cultivate their independent thinking and self-learning abilities, and shape their scientific spirit of daring to innovate and break through by providing guidance frameworks, key literature clues, and other methods. In actual teaching, students learn through task driven learning, with an average increase of 30% in literature review and a significant improvement in problem-solving ability.

2.3.3 Case teaching method enhances practical ability

Select typical domestic and international cases such as "safety accidents caused by process design defects in a certain enterprise" and "technological breakthroughs achieved by innovative aggregation methods of a university research team", and organize students to conduct case studies. Through the teaching process of "case presentation problem analysis solution proposal summary reflection", cultivate students' thinking and ability to apply professional knowledge to solve practical problems, and strengthen their awareness of quality and responsibility. After the implementation of case teaching, students' comprehensive and in-depth consideration of problems in course design has significantly improved.

2.3.4 Practical teaching method to solidify operational skills

Strengthen laboratory practical teaching and offer experimental courses such as polymerization reaction operation and polymer material performance testing. During the experimental process, students are strictly required to follow the operating procedures and cultivate a rigorous and practical scientific attitude; Complete experimental tasks through team collaboration and strengthen safety responsibility awareness; Guide students to conduct in-depth analysis of experimental results and cultivate critical thinking and innovation abilities. At the same time, a virtual simulation experimental platform is introduced to simulate the operation and control of large-scale polymerization reactors, making up for the limitations of actual equipment. After using the virtual simulation experimental platform, students' mastery of complex process operations has increased by 40%.

2.4 Reform of Course Evaluation Mechanism

2.4.1 Optimize assessment content and weight

Redesign the course assessment plan to increase the proportion of process assess-

ment to 60%, including classroom participation (20%), group cooperation performance (20%), and practical operation scores (20%); The final assessment is mainly presented in the form of a thesis, accounting for 40%. In the process assessment, the focus is on students' teamwork spirit, safety awareness, and responsibility; The final assessment includes open-ended questions related to ideological and political education, such as "Combining polymer reaction engineering knowledge to explain the responsibilities and missions of scientific and technological workers in achieving the 'dual carbon' goal", comprehensively testing students' comprehensive application ability of professional knowledge and ideological and political concepts.

2.4.2 Refine ideological and political assessment indicators

Develop a detailed ideological and political assessment index system, and quantitatively evaluate it from dimensions such as "scientific spirit", "social responsibility", "teamwork", and "patriotism". For example, in the performance evaluation of group cooperation, specific indicators such as "whether to actively undertake tasks" and "whether to actively coordinate team conflicts" are set; In practical operation assessment, "whether to comply with safety regulations" and "whether to pay attention to environmental protection and energy conservation" are included in the scoring criteria to ensure that course evaluation can scientifically and objectively reflect students' ideological and political growth and value shaping.

3. Problems and Reflections

3.1 Existing Problems

Insufficient depth of integration of ideological and political elements: In some teaching content, the integration of ideological and political elements with professional knowledge only stays on the surface, without fully exploring the internal connections, resulting in the phenomenon of "ideological and political for the sake of ideological and political education".

Limited innovation in teaching methods: Although diversified teaching methods are adopted, some of them have not achieved the expected results in implementation. The virtual simulation experiment platform lacks interactivity and immersion, and the task driven teaching method has an unreasonable difficulty gradient in task design.

The instability of school enterprise cooperation in educating students: the participation of enterprise engineers in teaching is greatly affected by the production plan of the enterprise, and the continuity of teaching activities is difficult to ensure; The collaborative mechanism between schools and enterprises in the design of ideological and political courses is not perfect, and some teaching content is disconnected from the actual needs of enterprises.

3.2 Improvement direction

Deepen the research on ideological and political integration: Organize teaching

teams to conduct special seminars and training, invite ideological and political education experts and industry scholars to participate together, deeply explore the integration of ideological and political elements in courses with professional knowledge, and develop high-quality and in-depth ideological and political cases in courses.

Continuously innovating teaching methods: increasing investment in the construction of virtual simulation experiment platforms, optimizing platform functions and user experience; Establish a feedback mechanism for teaching method effectiveness, dynamically adjust task design based on students' learning situation, and ensure that teaching methods are effective.

Improve the school enterprise collaboration mechanism: sign long-term stable teaching cooperation agreements with partner enterprises, clarify the responsibilities and rights of both parties in curriculum ideological and political construction; Regularly organize school enterprise joint teaching and research activities, jointly develop curriculum ideological and political teaching resources, and achieve precise alignment between teaching content and actual needs of enterprises.

4. Conclusion

This project focuses on the ideological and political construction of the course "Polymer Reaction Engineering" for Master's students in Materials Engineering. Through systematic exploration and practice in the construction of teaching objectives, content reform, method innovation, and evaluation optimization, significant achievements have been made. In the future, the project team will continue to deepen the reform of ideological and political education in courses, improve and perfect existing problems, further enhance the quality of curriculum education, contribute to the cultivation of new era material engineering talents with solid professional knowledge, noble moral character, and strong sense of social responsibility, and actively promote project experience to assist in the high-quality development of ideological and political education in material related courses in universities. First, confirm that you have the correct template for your paper size. This template has been tailored for output on the custom paper size (21 cm * 28.5 cm).

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