ISSN 2663-8169 Vol. 6, Issue 2: 258-264, DOI: 10.25236/IJNDE.2024.060239

Reform and Exploration of the Integration of "Principles of Chemical Engineering" Course and Civic and Political Education in the Context of Professional Accreditation of Engineering Education

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Abstract: *The deepening of the professional certification system of engineering education has put forward the reform requirements for the curriculum system and teaching methods of institutions of higher education in order to meet the demand for the cultivation of innovative engineering talents. The purpose of this study is to explore the necessity of integrating the "Principles of Chemical Engineering" course with the Civic and Political Education and the path of reform and exploration in the context of professional certification of engineering education. By analyzing the characteristics of chemical engineering and technology courses and the connotation of Civic and Political Education, the study proposes a specific integration strategy and suggests how to implement the reform efficiently.*

Keywords: *Engineering Education Accreditation, Chemical Principles, Civic and Political Education, Curriculum Reform*

1. Introduction

The current trend of global accreditation of engineering education has put forward the requirement of comprehensive improvement of curriculum system, teaching content and quality for engineering programs in higher education institutions [1]. This accreditation system emphasizes the result-oriented design of the curriculum, which not only needs to comply with the industry standards, but also needs to adapt to the future development trend of engineering and technology and social needs [2]. In this context, as a professional basic course, the "Principles of Chemical Engineering" course of chemical engineering and technology majors not only shoulders the task of teaching professional knowledge, but also takes the responsibility of cultivating students' sense of social responsibility, innovative spirit and engineering ethics [3]. At the same time, as an important means to improve students' ideological and moral cultivation and scientific and cultural quality, Civic and political education should be combined with professional education to promote the overall development of students [4].

2. Teaching Objectives of "Principles of Chemical Engineering" course in the Context of Professional Accreditation of Engineering Education

With the increasing popularity of engineering education accreditation, the key chemical engineering and technology professional course "Principles of Chemical Engineering" is stepping into a more diversified and far-reaching teaching orientation. As a professional core course, its role has long since broken through the boundaries of simply teaching traditional professional knowledge, and has shifted to taking on a wider range of teaching tasks, and comprehensively shaping professionals with interdisciplinary comprehensive skills and practical application of ability.

2.1 Cultivate Students' Sense of Social Responsibility

When teaching the course "Principles of Chemical Engineering", teachers must emphasize students' sense of social responsibility. They need to make students understand that real engineering projects are closely related to society and the environment. Teachers can inspire students to take responsibility and initiative by analyzing a number of engineering cases and leading them to pay reasonable attention to and

ISSN 2663-8169 Vol. 6, Issue 2: 258-264, DOI: 10.25236/IJNDE.2024.060239

understand the long-lasting impact that these projects may have on society and the environment. At the same time, teachers can also encourage students to participate in various social practice activities, such as visiting chemical engineering enterprises, participating in community greening projects or becoming volunteers, so that they can experience the actual engineering environment. By actually participating in problem identification, analysis, and solution development, students have the opportunity to intuitively experience the inextricable balance between scientific and technological advancement, public interest, and environmental protection in a real engineering environment. This means that students can deeply understand their roles and responsibilities as future chemical engineers, develop a strong sense of social responsibility, and become comprehensive chemical talents with good professionalism, humanistic care, and the concept of sustainable development.

2.2 Stimulate Students' Innovative Spirit

In the course of "chemical principles", we should not only impart profound theoretical knowledge, but also devote ourselves to shaping students' innovative way of thinking. The goal is to allow students to absorb and master the theoretical knowledge of chemical engineering principles, while encouraging them to break out of the box, try innovative thinking and practice. It is hoped that when they are faced with complex engineering problems, they will be able to stand in the perspective of the user's needs, and find the most suitable solution after many optimizations and corrections. In addition, we also introduce more challenging research training and engineering challenge programs, such as experimental competitions, research projects and innovative research projects. When dealing with real-world chemical engineering problems, students are able to experience first-hand the entire process of developing an innovative concept, justifying a design, constructing a prototype, and finalizing a product. Such experience can not only exercise their practical skills and hands-on ability, but also stimulate their enthusiasm and potential for innovation, and truly shape engineering talents with in-depth understanding of chemical engineering theories and excellent innovation ability.

2.3 Strengthen the Education of Engineering Ethics

When teaching the course "Principles of Chemical Engineering", the introduction of engineering ethics education must be emphasized. In order to deepen students' understanding of the core values of engineering ethics, we can try to add ethical issues into the course design, including the discussion of ethical dilemmas and their coping strategies in engineering practice, the analysis of relevant cases, as well as the moral considerations that need to be faced in the process of technological innovation and social development. By emphasizing the importance of the principles of honesty, fairness and sustainable development in engineering practice, students will understand their own responsibilities and missions in adhering to the code of professional ethics, safeguarding public welfare and protecting the ecological environment. While helping students to shape a sound view of engineering ethics, they will learn how to take into account legal, ethical and economic gains when dealing with issues related to the chemical profession.

2.4 Integration of Civic and Political Education

In the teaching practice of "Principles of Chemical Engineering" course, it is necessary to break the traditional boundaries between professional knowledge and ideological and political education, and actively explore new ways of deep integration. While teaching the theoretical knowledge of chemical principles, students are inspired to establish a correct outlook on life and value orientation. The elements of ideology and politics are skillfully integrated into the classroom design, such as planning special lectures and interpreting the ideological orientation behind major scientific and technological achievements at home and abroad. In addition, various kinds of social practice and voluntary service activities can be organized to let students perceive the national conditions and public opinions in practical situations. Through the teaching strategy led by professional skill cultivation and assisted by ideological education, high-quality chemical engineering technicians with excellent chemical expertise, firm ideals and a strong sense of social responsibility can be shaped, thus contributing to the economic and social development of the country.

2.5 Emphasize the Cultivation of Practical Ability

When teaching the course "Principles of Chemical Engineering", we can try various ways to help students develop and enhance their practical skills. For example, we can carry out rich experimental

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teaching, so that students in the process of hands-on design of experimental programs and data processing, in-depth understanding of the essence of the principles of chemical industry in the actual operation and application of the scene; industrial internships can be organized, so that students go directly into the chemical plant, first-hand experience of the production line operation and management, so as to enable them to have a better understanding of the chemical industry, the production process and the actual operation of the skills; can also encourage students to participate in real scientific research projects, so as to enhance the practical skills of the students. Students to participate more in real scientific research projects and collaborate with enterprises to jointly develop environmentally friendly chemical production processes, so as to cultivate their practical abilities in the process of participation in project planning, technology development, cost management and benefit assessment.

3. The Necessity of Integrating the "Principles of Chemical Engineering" Course With Ideological and Political Education in the Context of Professional Accreditation of Engineering Education

In "Principles of Chemical Engineering", which is an important professional foundation course for chemical engineering and technology majors, injecting the education of engineering ethics and social responsibility plays a decisive role in cultivating students' sound professional values. In the teaching and learning activities of this course, special emphasis should be placed on the integration of such elements as engineering ethics and social responsibility into the teaching content, which will have a significant positive impact on the overall development of students:

(1) Through the integration of Civic-Political elements, the cultivation of social responsibility awareness is systematically strengthened, so that students will consciously examine and consider the environmental and social effects that their own behavior may bring in their future careers. This kind of value, which combines both professional growth and social responsibility, will lead them to make positive and valuable contributions to the realization of a greener, more harmonious and sustainable social development while practicing their chemical engineering expertise.

(2) Through the integration of Civics and Politics elements, we strive to cultivate students' ethical insight in practical engineering training, so that they can quickly capture and recognize ethical and moral issues in the ever-changing working environment. This ability to be keenly aware of ethical issues and make decisive choices will strongly support their ability to always adhere to the bottom line of professional ethics in the process of solving practical engineering problems, and to demonstrate a high degree of professional ethics and a good sense of social responsibility.

(3) Through the integration of the elements of ideology and politics, students' moral knowledge and practical ability are strengthened in the current chemical industry, which pays special attention to the optimal use of resources and the prevalence of the concept of environmental protection. Such a cultivation mode helps students to deeply understand and actively promote the practice of sustainable development strategies, whether it is to optimize the use of resources, reduce environmental pollution, or to seek innovative applications of the circular economy model, which can help the transformation of the green development of the entire chemical industry at the individual level.

(4) The integration of Civics and Politics elements helps to improve students' overall decision-making ability, so that they can balance economic efficiency and moral responsibility when facing engineering technology selection, and demonstrate a higher level of professionalism.

(5) The integration of Civics and Politics elements into the professional curriculum fully meets the requirements of the current internationally accepted quality accreditation system for engineering education. While insisting on the provision of core teaching content consistent with the world's top engineering practices, our goal is to cultivate international talents who are not only competent in the domestic engineering field, but also have the ability to emerge and demonstrate strong competitiveness in the globalized engineering arena.

4. Reform Path of "Principles of Chemical Engineering" Course Integrating Civic and Political Education in the Context of Engineering Education Professional Accreditation

4.1 Course Content Integration

In the training program and syllabus of "Principles of Chemical Engineering" course, the elements of

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Civic and Political Education should be integrated. A series of in-depth thematic contents can be arranged, such as "interaction between chemical engineering and sustainable development strategy", "analysis and reflection on typical engineering ethics examples", and "the key role of environmental policy in driving the transformation of chemical engineering manufacturing industry". The key role of environmental policy in driving the transformation of the chemical engineering manufacturing industry". The aim is to train students to be able to fully grasp the principles of engineering ethics in chemical engineering practice, to fully recognize the necessity and urgency of sustainable development in the chemical industry, and to pay attention to the indispensable role of environmental protection in this development process. Students are guided to apply the theoretical knowledge of chemical engineering principles skillfully, and at the same time, they are required to closely integrate this theoretical knowledge with the concepts of moral responsibility, social responsibility and environmental protection in practice, so as to become excellent chemical engineering talents with global vision, forward-looking thinking and practical application ability.

4.2 Teaching Method Reform

In the teaching process of "Principles of Chemical Engineering", we focus on adopting interactive teaching methods to increase students' participation, enhance students' practical experience, cultivate students' awareness of active thinking, and cultivate students' communication and teamwork skills at the same time. For example, the case teaching method can be adopted, in which the teacher selects practical problems closely related to chemical principles for teaching. In the classroom, students can read and study the cases by themselves, then express their opinions and propose solutions to the problems, and finally have group discussions. Teachers can play the roles of mentors and critics in guiding students to a deeper understanding of course content and substantive issues. Team discussion is also an important interactive teaching method, in which students can be divided into groups according to the course topics and assigned discussion topics on green chemical process design. Teams need to complete their designs and share their solutions with the whole class, which not only helps to enhance cooperation among team members, but also improves their application of chemical principles knowledge by presenting their learning outcomes. In addition, technology can also be used in the classroom for interactive forms such as voting, real-time feedback or debates to motivate students and enliven the classroom atmosphere. Finally, virtual chemical scenarios can be set up, allowing students to play diverse roles such as engineers, environmental supervisors, business leaders and community representatives to participate in cross-role discussions and collisions of ideas.

4.3 Evaluation Mechanism Innovation

In order to cultivate high-quality chemical professionals, it is necessary to break the traditional single knowledge assessment framework and build a diversified evaluation system that includes basic professional knowledge and non-technical skills, so as to build a new evaluation system for the teaching of the "Principles of Chemical Engineering" course. Under this framework, we will design diversified assessment modes, such as regular quizzes, post-course assignments, combined with classroom seminars, group collaborative projects, written research reports, etc., to systematically track and evaluate the progress of students in the acquisition of theoretical knowledge of "Principles of Chemical Engineering", as well as their growth in the quality of ideological and political education and the cognition of engineering ethics. We systematically track and evaluate the students' progress in acquiring theoretical knowledge of "Principles of Chemical Engineering" and their growth in ideological education and engineering ethics.

With the help of advanced statistical analysis tools, we will integrate the performance data from various dimensions, such as theoretical tests, practical experience, case study analysis, group discussion participation, classroom performance, personal self-reflection and peer evaluation, and finally generate a detailed report on the assessment of students' comprehensive quality and ability. In this evaluation process, we pay special attention to the proportion of students' independent thinking ability and practical problem solving skills in the process of solving real-life chemical problems, and at the same time, for the examination of the experimental section, we not only pay attention to the degree of mastery of the students' practical skills, but also emphasize the importance of strict compliance with the engineering code of ethics and environmental protection related needs in the process of execution.

Such an all-round evaluation system not only strictly measures the students' mastery of "Principles of Chemical Engineering" from the level of professional skills, but also fully takes into account their soft strengths in non-technical fields (including but not limited to ideological and political literacy,

ISSN 2663-8169 Vol. 6, Issue 2: 258-264, DOI: 10.25236/IJNDE.2024.060239

engineering ethics, etc.), which strongly promotes the students' professional skills in the process of growing up to be qualified engineers, and also their professional skills in the process of developing into qualified engineers. In the process of growing up to be a qualified engineer, the overall enhancement and development of students' professional skills and qualities are strongly promoted.

5. Implementation Strategies for the Reform of "Principles of Chemical Engineering" Course in the Context of Professional Certification of Engineering Education and the Integration of Ideological Education

5.1 Strengthen the Construction of Teachers

In order to realize the perfect combination of ideological and political education and professional education of "Principles of Chemical Engineering" in teaching, it is necessary to improve the teachers' business level and ideological understanding, and it is feasible to strengthen the construction of teachers' team. For example, we can make teachers understand the latest teaching concepts and realize the indispensable position of ideological and political education in professional teaching through conference training, seminars and workshops. During the professional training, teachers will learn how to utilize a variety of interactive teaching methods, such as case studies, role-plays and group discussions, share their practical experience, explore how to introduce elements of ideological and political education in a smart way, and create a rich and inspiring learning environment. The university guides teachers to incorporate elements of ideological and political education into the selection and development of teaching materials through policy guidelines to ensure that topics such as engineering ethics and social responsibility are closely integrated into the basic theory course of "Principles of Chemical Engineering". Experts in related fields are invited to give lectures and seminars to help teachers acquire cutting-edge information to understand the interrelationship between the subjects they teach and the basic principles of chemical engineering courses. At the same time, schools should design all-round training programs covering theories of Civic Education, teaching strategies and case studies, so that teachers can fully master all the necessary skills on how to apply Civic Education to teaching. Schools can also set up internal resource databases to facilitate teachers' use of Civic-Political education resources, including various types of teaching cases, simulation games, and film materials, etc., so that they can be used directly by teachers in the teaching process. Schools should provide financial and time support for teaching and research projects to motivate teachers to actively explore the path of effectively combining Civic and Political Education with the teaching of basic principles of chemical engineering as a way to continuously improve and optimize the quality of teaching. The school should strongly encourage the teaching and research department to hold regular teaching reflection meetings to stimulate interaction and communication among teachers and to jointly meet the challenges, with a view to continuously improving the teaching process.

5.2 Building an Interdisciplinary Teaching Platform

An efficient, interdisciplinary teaching team comprising teachers of Chemistry and Chemical Engineering and other subjects can be established with the aim of developing highly qualified chemical engineers. The senior management of the school can be actively involved and supportive and provide the required policies and resources to attract teachers to commit to this all-rounded teaching and learning environment by supplying research funds, rationalizing the allocation of working hours, and establishing an incentive system. It is also important to establish common pedagogical goals, such as fostering a holistic view of students, teaching them critical thinking, and problem-solving skills. All team members must have a deep understanding of these goals. To ensure that the team can communicate and collaborate effectively, we need to establish a regular online or offline teaching discussion platform or meeting process. For example, pinning and Tencent meetings are very effective online collaboration tools for real-time online communication and resource sharing. Regular interdisciplinary education workshops can encourage teachers to share their expertise, find commonalities, and enhance understanding and collaboration. Interdisciplinary team members are encouraged to work together on student projects and case studies. This authentic collaborative environment allows teachers to develop a deeper understanding of cooperation and provides students with a diverse learning environment for a richer intellectual experience. Schools can launch professional development workshops to further enhance interdisciplinary teaching skills, focusing on training in curriculum integration design and teamwork skills to help teachers better adapt to and take advantage of interdisciplinary teaching.

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5.3 Improve Teaching Resources

The first step in developing teaching resources for the "Principles of Chemical Engineering" course is to clarify the objectives, aiming at cultivating students' sense of social responsibility, engineering ethics and environmental protection. Focusing on the core content of the course - resource conservation and environmental protection in the chemical process, potential entry points for Civic and Political Education are explored, such as integrating case studies and practical applications in the lectures. In order to ensure the quality and practical value of the resources, the development process should focus on dynamic updating with the participation of multiple parties, and regularly collect feedback from students and teachers, and amend and improve the teaching resources accordingly. Specific measures include:

(1) Prepare and collect cases of engineering ethics, environmental protection and sustainable development in the field of chemical industry to ensure that the cases are vivid and close to reality, resonate with students and are closely integrated with the course content.

(2) Plan or select a set of ideological and political education videos (including documentaries, interviews or animations) involving chemical engineering principles, mainly showing the ethical, social and environmental issues involved in chemical engineering principles in daily life.

(3) Invite professionals from the fields of engineering ethics and environmental protection to give lectures, and use the lecture videos as part of the teaching materials to delve into practical examples of good ethics and social responsibility through in-depth dialogues.

(4) Design highly interactive teaching courseware and simulation software, such as chemical plant simulation software, so that students can directly experience the application of chemical engineering principles in real societies and environments as well as their possible impacts through role-playing and simulation of real-life scenarios.

(5) Encourage teachers to actively engage in pedagogical research, stimulate them to independently develop Civic and Political Education teaching materials that match the "Principles of Chemical Engineering" course, and provide the necessary support for this process in terms of funding and time.

(6) Encourage students to take the initiative to co-create teaching resources. For example, the collection and creation of Civic and Political Education cases related to the principles of chemical engineering through course projects or competitions will make the learning closer to the students' real life.

(7) A resource sharing platform with convenient and fast search function can be constructed, on which users can quickly find the required teaching resources according to the topics, keywords or course requirements. This will realize the sharing and value-added of teaching resources and further promote the high-quality development of "Principles of Chemical Engineering" ideological education.

5.4 Strengthening the Practical Sections

Integrating engineering project design into the teaching process of "Principles of Chemical Engineering" and guiding students to formulate and implement solution strategies for practical problems can effectively improve their practical skills and their ability to comprehensively apply these skills. This approach allows students to improve key skills such as project management, teamwork, communication skills and critical thinking while solving real-world problems, and significantly enhances their ability to translate theoretical knowledge into practice. During the implementation process, designed engineering projects can be closely integrated into the course content. This can be done by cooperating with enterprises to solve real engineering problems, such as challenges in energy saving, emission reduction and environmental compliance, for example, designing a set of energy-saving chemical production processes. Chemical simulation software can be used to operate and optimize the production process in the field, and basic operation skills can be improved under the guidance of teachers. Upon completion of the project, students are required to comprehensively analyze the results they have achieved, organize a presentation evaluation, and are asked to write a comprehensive report including technical, economic benefits and environmental impact assessment, and invite industry experts to provide feedback. During the course of the project, students are expected to conduct small experiments in the laboratory to verify the integration of theory and practice and try to explore the meaning behind the engineering data through innovative experimental methods. Throughout the project, the importance of safety rules and engineering ethics is emphasized, and students are taught to give due consideration to the safety and moral responsibility of their designs. At the end of the project, students are encouraged to reflect and

ISSN 2663-8169 Vol. 6, Issue 2: 258-264, DOI: 10.25236/IJNDE.2024.060239

summarize, share their learning experiences, problem-solving approaches and results achieved, which are detailed through oral or written reports to deepen their understanding and knowledge of the whole project.

6. Conclusion

Responding to the call for professional accreditation of engineering education, integrating the "Principles of Chemical Engineering" course with ideological and political education is a key step in shaping outstanding engineers to meet the requirements of modern society. Through in-depth exploration and integration of the course content, improvement of teaching methods to enhance practicality and innovativeness, innovation of the assessment system to emphasize the assessment of all-round competence, and resolute implementation of the integration and execution strategies, students' professional skills and sense of social responsibility can be effectively stimulated to promote their complete development. The aim of this initiative is to develop not only people with profound engineering knowledge but also complex human resources who can take up the responsibilities of the times and social obligations to meet the needs of the modern industrial development.

Acknowledgement

This work was supported by Yulin College School-level Educational Reform Program (No. JG2351) and Ministry of Education Industry-University Cooperation Collaborative Education Program (No. 230805862153129).

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