

Cases Design and Analysis of Ideological and Political Innovation Teaching of Water Pollution Control Engineering

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Abstract

As the core course of environmental science and engineering, Water Pollution Control Engineering is an important position to practice ideological and political education. In order to give full play to the role of the course in “educating people”, the ideological and political elements contained in the course are excavated from the aspects of life attitude, ideal and belief, family and country, professionalism, etc., and typical cases in the main teaching modules are designed and analyzed. Through the innovative integration of professional knowledge and ideological and political education in the classroom, new vitality is injected into teaching, the unity of “teaching” and “educating people” is realized, and the goal of “all-round education” can be achieved.

Keywords

Courses on the ideological and political dimension; Elements; Water Pollution Control Engineering; teaching case.

1. Introduction

With the promotion of the concept of courses on the ideological and political dimension, ideological and political education has been incorporated into the curriculum construction of universities, becoming an important way to implement the task of “establishing morality and cultivating talents” in universities [1, 2]. As a core course of environmental science and engineering, the teaching of Water Pollution Control Engineering aims to enable students to master the basic theory, scope of application, process and design calculation of common methods of water pollution prevention and control, understand the cutting-edge technology of water pollution control, and then have the theoretical knowledge to engage in the design, operation management and scientific research of water pollution control engineering. The Water Pollution Control Engineering course is rich in teaching content and wide in knowledge coverage, which contains many elements of ideology and politics, and has become an important position for the environmental science and engineering majors to carry out ideological and political education.

Therefore, this paper takes the teaching of Water Pollution Control Engineering course in Chengdu Technological University as an example, refines the content of the course with ideological and political elements, reasonably designs and analyses the teaching cases, and discusses how to organically integrate ideological and political concepts into the teaching of Water Pollution Control Engineering course, so that students can enhance their theoretical knowledge and at the same time complete the cultivation of ability and value shaping.

2. Ideological and Political Elements to Explore

2.1. Life Attitude

Life attitude is an important reflection of students' outlook on life, cultivating a positive and optimistic life attitude is one of the important ideological tasks of the Water Pollution Control Engineering course. Most of the roles and principles of wastewater treatment methods can be sublimated to the level of life attitude, for example, through the study of the precipitation method, students are guided to sink their hearts, constantly improve their own state of mind, cultivate their own character, and strive towards the goal of a wonderful life; through the study of the filtering method, students are guided to learn how to distinguish between right and wrong and filter out the bad aspects of life; through the study of the neutralising method, students are guided to regulate their negative emotions and are encouraged to face up to the negative aspects of life, accept their imperfections and work hard to improve themselves.

2.2. Ideals and Beliefs

As the main force to promote the future development of society, college students should have firm ideal beliefs, have faith, aspire and pursue towards the set goal and strive hard [3]. In the course lecture of Water Pollution Control Engineering, with water pollution control as the target, the history of the development of water environmental protection in China should be introduced, and the research and development of water purification technology in China should be introduced to inspire college students to keep forging ahead, to implant ideals and beliefs in their hearts and put them into practice, to always adhere to ideals and beliefs, to embrace their sincere loyalty to the Party, to strive hard on the road of building a beautiful China, and to shine on the journey of fulfilling the Chinese dream.

2.3. Family and Country

As the excellent traditional culture of the Chinese nation, family and nation sentiment is an important spiritual force to promote the positive progress of contemporary college students [4]. Cultivating strong and deep family and country sentiment among college students is an important content of the Water Pollution Control Engineering course. In classroom teaching, teachers should not only take the lead and teach by example, but also excavate the value of the elements of family and country sentiment in the textbook, such as the patriotic stories of scientists in the field of water treatment and analogous cases in the principles of water treatment process, all of which can be dug deep and refined. Through the teaching of typical cases, patriotic awareness can be enhanced, and this awareness can be carried through to all aspects of life.

2.4. Professionalism

Professionalism is the foundation of an individual in the industry, which includes good professional character such as love for work, dedication, self-discipline, innovation, selfless dedication, honesty and trustworthiness, solidarity and cooperation, and craftsmanship [5]. In the teaching of the Water Pollution Control Engineering course, students should be guided by teaching, case implantation, behavioural shaping and other ways to cultivate professional skills in water treatment, and at the same time, let them have a rigorous and pragmatic professional style, with a professional quality of dedication, with the professional vitality of innovation and dare to break through, both a solid theoretical level, but also a solid practical ability, for the construction of ecological civilization and ecological environmental protection work.

3. Teaching Cases Design and Analysis

3.1. Teaching Modules on Physical and Chemical Methods

3.1.1. Case I

Vehicle for ideological and political education: Pressurised dissolved air flotation.

Ideological and political element: Maintaining a positive attitude towards life, turning pressure into motivation and challenges into opportunities.

Knowledge content: Pressurised dissolved air flotation is a common means of air flotation sewage treatment, its principle is to dissolve a large amount of air into the sewage under pressurised conditions until saturation, and then restore the pressure level to atmospheric pressure, at this time the dissolved air in the water will form a large number of small bubbles released, bubbles in the process of rising will carry pollutants to the surface. The fine impurities in the sewage are separated from the sewage by this process to achieve purification.

Class discussion: Pressurised dissolved air flotation is a process of “pressurising” and then “releasing the pressure” to achieve sewage purification, so in study, work and life will also encounter a variety of pressure, how to face?

Integration of ideological and political education: Pressure is everywhere, it will make people’s psychological burden increased, and even due to excessive pressure to make some low-level mistakes. So how do you turn pressure into motivation? First of all, you should recognise the trouble that pressure causes to you, then sort out the main sources of pressure, gradually break down the big pressure into smaller ones, and develop corresponding release methods and encouragement measures for the solution of the smaller ones, and finally turn the pressure into motivation to move forward and upgrade the challenges into valuable opportunities.

3.1.2. Case II

Vehicle for ideological and political education: Advanced oxidation processes.

Ideological and political element: Maintaining an optimistic outlook on life, accepting imperfections and striving to be stronger.

Knowledge content: Advanced oxidation processes, as an advanced wastewater treatment technology, use various types of free radicals with strong oxidizing properties (e.g. hydroxyl and sulphate radicals) as oxidants to degrade organic pollutants in wastewater.

Class discussion: Unlike normal molecules or atoms, free radicals are substances that lack electrons and have certain “residuals”, but they have gained a stronger oxidising power and can be applied to the efficient oxidation of pollutants. What have you learned from this?

Integration of ideological and political education: Everyone’s life is not perfect. There are gains and losses, joys and pains, successes and failures. It is these imperfections that make each person’s life unique. In the face of life’s imperfections, you should maintain an optimistic heart, just like the free radical, although the loss of electrons, but can “shine” in the sewage treatment. Learn to accept your imperfections, and at the same time strive to become better; learn to face your shortcomings, and at the same time find your strengths and weaknesses to be stronger.

3.1.3. Case III

Vehicle for ideological and political education: Coagulation.

Ideological and political element: Maintaining strong ideals and beliefs, following the Party with unity of purpose and building the Chinese dream together.

Knowledge content: The key to achieving coagulation is to remove or reduce the Zeta potential of colloidal particles in sewage, so that they can collide and agglomerate, and finally settle down to achieve the purpose of sewage purification.

Class discussion: The existence of “Zeta potential” in colloidal particles is just like the existence of various “obstacles” in the process of building socialism with Chinese characteristics in the new era, what should young students do?

Integration of ideological and political education: In the process of building socialism with Chinese characteristics in the new era, there are many factors that hinder development, and it is imperative to remove those “roadblocks” and “stumbling blocks” that hinder high-quality social and economic development. As young university students, they should firstly establish firm values, remove ideological barriers, fully mobilise their enthusiasm and creativity, be of one mind and one heart with the Party, follow the Party’s pace in their thinking and uphold the Party’s core; secondly, they should remove formalistic barriers, be pragmatic and practical, move steadily forward, concentrate on following the Party and build the Chinese dream together.

3.1.4. Case IV

Vehicle for ideological and political education: Ion exchange.

Ideological and political element: Maintaining a deep sense of family and country, giving up the small to achieve the big.

Knowledge content: Ion exchange method is to use ion exchange agent as water treatment material, using the exchangeability between exchangeable ions and target ions in wastewater to complete ion exchange and achieve the removal of toxic and harmful ions in wastewater process.

Class discussion: What can be learned from the fact that ion exchange agents “give up” their own ions in exchange for the purification of wastewater?

Integration of ideological and political education: The willingness to give up one’s own personal interests and the interests of a small group in order to protect the interests of all, the collective, the nation and the country is an admirable spirit of sacrifice, a rare and valuable spiritual strength. In the flood of history, there have been countless warriors who have fought for peace, each sacrifice only for a piece of peace. As a young university student in the new era, you should not limit yourself to your own development, but integrate yourself into the construction of the motherland, make greatness out of the ordinary, add bricks to the construction of the motherland with your own strength, write a new height of life in love with the Party and the country, take up the heavy responsibility given by the times with the heart of the family and the country, and achieve greatness.

3.2. Teaching Modules on Biochemical Methods

3.2.1. Case I

Vehicle for ideological and political education: Biofilm method.

Ideological and political element: Maintaining a strong sense of family and country, with the belief that only when there is a country can there be a family and only when there is a family can there be me.

Knowledge content: Biofilm method is a commonly used method of wastewater purification. Microorganisms attach and grow on a carrier with solid properties, gradually forming a membrane composed of a large number of microbial communities and using the biochemical function of the membrane to complete the treatment of pollutants.

Class discussion: Compare the major differences between biofilm and activated sludge water purification, and then discuss the relationship between individual, family and country.

Integration of ideological and political education: The main difference between biofilm and activated sludge is that microorganisms in biofilm are attached to a carrier, while in activated sludge they grow in suspension. The “carrier” here is like a plot of “land” on which the microorganisms adhere to, and nestle, forming a biofilm, which grows and metabolises in this

base camp. In contrast, the microorganisms in activated sludge are more like a floating community, and therefore less resistant to load shocks. Each person is like a microorganism, and the motherland is the “carrier”. As they grow, they have a home (like a biofilm), a shelter from the wind and rain, and a haven against external shocks. Only when our country is strong will we have a peaceful home and a secure life. If the skin does not exist, how can the hair be attached? To keep the flower of happiness blooming, we need to be loyal and love our country and family, and to fight for the peaceful reunification and prosperity of our motherland.

3.2.2. Case II

Vehicle for ideological and political education: Up-flow anaerobic sludge bed reactor (UASB).

Ideological and political element: Maintaining a noble professionalism, indifference to fame and selflessness.

Knowledge content: The UASB is a highly efficient anaerobic bioreactor developed by Professor Gatze Lettinga in the Netherlands in 1972, and is a core technology shared worldwide for wastewater treatment.

Class discussion: What spiritual qualities does Professor Gatze Lettinga exemplify by choosing to make the technological invention he created available to the world and working to train technology promoters for developing countries?

Integration of ideological and political education: The research results of Professor Gatze Lettinga’s team have not only made a remarkable contribution to the development of anaerobic biotechnology in the world, but his noble professionalism has also had a profound impact on the promotion and development of anaerobic biotechnology in China. He has influenced generations of environmentalists through his unselfishness and dedication. From ancient times to the present, countless scientists have dedicated themselves to the advancement of science and technology. History and reality also prove that without these selfless scientists, there would not be the development of the world today, let alone the people’s happy life. Therefore, in this new period of historical development, we should vigorously promote the spirit of selfless professionalism and contribute to the steady development of our country and the great rejuvenation of our nation, while at the same time being broad-minded and demonstrating a generous spirit of internationalism for the purpose of seeking the common welfare of all mankind.

3.2.3. Case III

Vehicle for ideological and political education: Sludge expansion and its control.

Ideological and political element: Maintaining a professional spirit of self-discipline and consciously preventing the expansion of ideas.

Knowledge content: Activated sludge has a strong water purification capacity when it maintains good settling performance. When the activated sludge swells, the problem of sludge-water separation becomes difficult, the activated sludge becomes bulky and loose in structure, the effluent contains high levels of sludge or pollutants in the water and the effluent is difficult to meet the standard discharge.

Class discussion: What are the causes of sludge expansion? How can we prevent the expansion of ideas in our work?

Integration of ideological and political education: Sludge expansion can be understood as a result of gluttony of filamentous or non-filamentous bacteria, which can lead to massive loss of painstakingly cultivated sludge, reduced removal of pollutants, and even the breakdown of the entire sewage treatment system. We also need to prevent the expansion of our minds at work. We need to be strict with ourselves and remember the adage “if the dike breaks, the air will leak”. It is necessary to take precautions so that we do not lose ourselves. In addition, we should

strengthen our studies, adhere to our principles, strictly adhere to the bottom line, overcome greed, make self-discipline our professional credo, and be a noble and pure person.

3.2.4. Case IV

Vehicle for ideological and political education: Short-cut nitrification and denitrification.

Ideological and political element: Short-cut nitrification denitrification is characterised by the word "short-cut". Through the reasonable regulation of process conditions, the oxidation of ammonia pollutants will stop at the nitrosation stage, no longer continue nitrification but directly use nitrite for denitrification. The process saves a lot of oxygen, carbon sources and time costs, and greatly improves the efficacy of biological denitrification of wastewater.

Knowledge content: Maintaining a creative professionalism, breaking the shackles of thinking and innovating shortcuts to development.

Class discussion: What does the development of full-scale nitrification and denitrification to short-cut nitrification and denitrification tell us about our future careers? What issues should we pay attention to in the process of exploring shortcuts?

Integration of ideological and political education: Full-scale nitrification and denitrification is an inherent mode of thinking, while short-cut nitrification and denitrification is an innovative mode of development. The seemingly simple transition from full-scale nitrification and denitrification to short-cut nitrification and denitrification has taken decades of exploration before it became known. In our future careers, we should be bold and innovative, not bound by the established mould of thinking, but open to the pressures and challenges. However, in the process of exploring shortcuts, we must refuse to be opportunistic, and only after thorough full preparation and reflection can we find the real shortcuts.

4. Summary

The introduction of the concept of curriculum ideology and politics has injected new strength into the construction and development of professional courses in colleges and universities, and has also put forward higher standards of course construction requirements. In the teaching of professional courses, teachers can no longer confine themselves to the traditional teaching, but should educate people in the process of teaching. The Water Pollution Control Engineering course is rich in content and has many elements of ideology and politics, so it is important to carry out ideological and political education in the teaching of this course. Through the identification of ideological and political carrier, the excavation of ideological and political elements, the explanation of knowledge content, the development of class discussions, the real integration of ideological and political elements into the hearts of students, and give full play to its ideological and political leading role, which is of great practical significance to improve the political and professional qualities of future environmentalists.

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