

OBE-Based Ideological and Political Education Reform in Water Pollution Control Engineering Courses

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Abstract: Taking the Water Pollution Control Engineering course at Chengdu Technological University as the research subject, this study explores the teaching reform and practice of course-based ideological and political education under the outcomes-based education (OBE) concept. Through an in-depth analysis of the actual conditions, the objectives of course-based ideological and political education were clarified, the development approach was outlined, a teaching system was constructed, and diverse teaching methods and case studies were designed. Practical outcomes demonstrate that OBE-based ideological and political education reform effectively enhances students' professional competence, social responsibility, and patriotic sentiments, providing valuable insights for similar initiatives at applied undergraduate universities.

Keywords: OBE, Water Pollution Control Engineering, Course-based Ideological and Political Education, Teaching Reform.

1. Introduction

Recently, China's higher education has continued to develop, and course-based ideological and political education, as an educational concept integrating ideological and political education into specialized course instruction, has garnered widespread attention [1]. As a core course in the environmental science and engineering major at applied undergraduate universities, Water Pollution Control Engineering closely relates to ideological and political elements such as environmental protection and sustainable development. It not only bears the responsibility of cultivating students' professional skills but also shoulders the important mission of guiding students to establish correct social responsibility and value perspectives while promoting green development [2]. The integration of ideological and political education into this course has revitalized its development, enabling it to comprehensively cultivate high-caliber, versatile talents who meet contemporary demands.

The outcomes-based education (OBE) concept emphasizes student-centeredness, competency orientation, and outcome-driven approaches, focusing on the achievements students

attain during their learning process, which aligns perfectly with the educational objectives of course-based ideological and political education [3-5]. In technically demanding courses like Water Pollution Control Engineering, how to skillfully apply OBE principles to optimize instructional design, uncover ideological and political elements, and achieve the organic integration of knowledge transmission, competency development, and value guidance remains a topic demanding in-depth exploration.

This thesis aims to explore an OBE-based teaching model for ideological and political education in the Water Pollution Control Engineering course at applied undergraduate universities. It conducts an in-depth analysis of the current teaching practices, reconstructs course content and methodologies in alignment with OBE principles, and seeks to provide valuable insights for achieving synergistic education in professional and ideological development at applied undergraduate universities.

2. OBE Concept and Course-Based Ideological and Political Education

2.1. OBE Concept

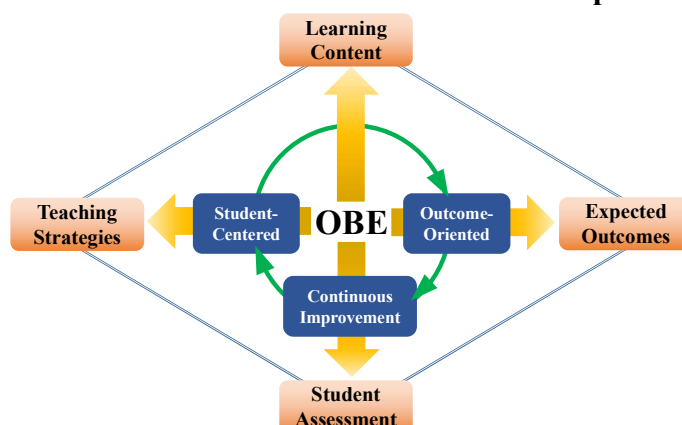


Fig. 1 The construct of OBE teaching concept

OBE is an educational model centered on students and guided by learning outcomes. It ensures graduates possess the

required knowledge, abilities, and qualities through clearly defined educational objectives, rational curriculum design, and effective teaching evaluations [6, 7]. The construct of the OBE teaching concept is illustrated in Figure 1. The core of the OBE concept lies in taking student learning outcomes as both the starting point and ultimate goal, emphasizing the cultivation of students' competencies and the enhancement of their overall qualities.

2.2. Course-Based Ideological and Political Education

Course-based ideological and political education refers to integrating ideological and political education throughout all types of course instruction. By identifying ideological and political elements within specialized courses, it combines knowledge transmission with value guidance to achieve holistic, comprehensive, and all-encompassing education [8]. This approach not only focuses on cultivating students' professional knowledge and skills but also emphasizes fostering their sense of social responsibility, patriotic sentiment, and sound values.

2.3. Integration of OBE Concept with Course-Based Ideological and Political Education

The OBE concept provides clear goal orientation and a scientific evaluation system for implementing course-based ideological and political education. By defining learning outcomes for ideological and political education, integrating these elements into course objectives, content, and assessment, the relevance and effectiveness of course-based ideological and political education can be significantly enhanced. Simultaneously, course-based ideological and political education enriches the implementation of the OBE concept with profound connotations and value guidance, enabling students to develop sound values and a sense of social responsibility while acquiring professional knowledge.

3. Current Status of Water Pollution Control Engineering Course

3.1. Course Positioning and Objectives

Water Pollution Control Engineering is a core course in the Environmental Science and Engineering program at Chengdu Technological University. It aims to equip students with fundamental principles, methods, and technologies for water pollution control, enabling them to address real-world water pollution challenges. Course objectives include: mastering

basic theories and methods of water pollution control; developing students' ability to analyze and solve practical water pollution problems; enhancing students' engineering practice skills and innovative thinking.

3.2. Teaching Content and Methods

Currently, the course content primarily covers fundamental principles of water pollution control, wastewater treatment processes, and wastewater treatment technologies. Instruction relies heavily on classroom lectures supplemented by case studies, laboratory sessions, and course design projects. While the curriculum is comprehensive, it falls short in integrating ideological and political elements, failing to fully explore the course's inherent ideological and political dimensions.

3.3. Teaching Evaluation

Course assessment primarily relies on examination scores, supplemented by laboratory reports and course design projects. The evaluation methods remain relatively limited, lacking a comprehensive assessment of students' overall competencies and ideological and political literacy.

4. OBE-Based Ideological and Political Education Reform

4.1. Setting Course Ideological and Political Objectives

Based on the OBE concept and in line with the practical context of the university's applied undergraduate education, the knowledge and competency objectives as well as the ideological and political objectives for the course Water Pollution Control Engineering have been established. Regarding knowledge and competency objectives, the aim is to enable students to master the fundamental principles, methods, and technologies of water pollution control, equipping them with the ability to solve practical water pollution problems. Regarding ideological and political objectives, the course cultivates students' sense of responsibility and mission toward environmental protection, strengthens their patriotic sentiments and social responsibility, guides them in establishing correct values and professional ethics, and fosters their innovative spirit and teamwork capabilities.

4.2. Implementation Approach for Course-Based Ideological and Political Education

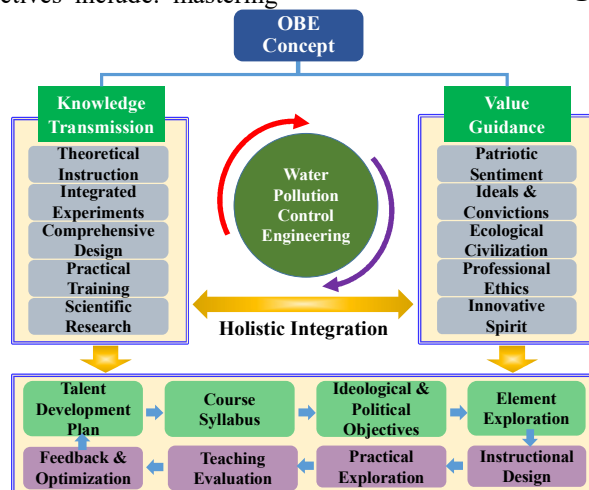


Fig. 2 Implementation approach for course reform

Guided by the OBE concept, the program optimizes the professional talent development plan and course outline, clarifies ideological and political objectives, and thoroughly explores course-based ideological and political elements. Through scientific instructional design, it integrates diverse teaching resources, mobilizes multi-faceted enthusiasm, deeply embeds ideological and political elements into the teaching process, and scientifically evaluates the practical outcomes. Continuously refine implementation strategies based on evaluation outcomes to achieve the dual objectives of unifying knowledge transmission with ideological education and integrating explicit instruction with implicit influence, thereby fostering subtle yet profound educational outcomes. The specific implementation approach is illustrated in Figure 2.

4.3. Establishing the Course-Based Ideological and Political Education Teaching System

Course Objective Design: Integrate ideological and political objectives into course teaching goals, clearly defining specific requirements for course-based ideological and political education. For example, add ideological and political objectives such as "cultivating students' sense of responsibility and mission toward environmental protection" to course objectives.

Instructional Content Design: Identify elements of course-based ideological and political education within the curriculum and organically integrate them with professional knowledge. For instance, when explaining wastewater treatment processes, link them to China's water scarcity and pollution challenges to foster awareness of water conservation and resource protection. When introducing wastewater treatment technologies, emphasize environmental protection to cultivate students' social responsibility.

Teaching Method Design: Employ diverse teaching methods to enhance the appeal and impact of course-based ideological and political education. For instance, utilize case studies, group discussions, and field research to allow students to experience the importance of environmental protection through practice; leverage multimedia teaching tools to showcase China's achievements and challenges in water pollution control, thereby inspiring students' patriotic enthusiasm.

Teaching Evaluation Design: Establish a diversified evaluation system incorporating ideological and political literacy into assessment metrics. For instance, conduct comprehensive evaluations through classroom participation, group discussions, lab reports, and course projects to holistically assess students' knowledge mastery, ideological awareness, and overall competence.

5. Teaching Methods and Case Design

5.1. Case Study 1: Field Research at a Wastewater Treatment Plant

Learning Objectives: Through field research at a wastewater treatment plant, students will gain practical knowledge of wastewater treatment processes and enhance their engineering skills. Additionally, students will be guided to examine the plant's environmental impact on surrounding areas, fostering a sense of responsibility toward environmental protection.

Teaching Process: Organize student visits to the plant, where technical staff will explain the treatment processes, capacity, and operational costs. Students will conduct field research in groups, documenting operational data and identifying existing issues. Facilitate group discussions to analyze the plant's environmental impact and propose improvement recommendations.

Identifying Ideological and Political Elements: During the research process, guide students to observe how the plant affects the lives of nearby residents, fostering a sense of responsibility toward environmental protection. By analyzing the plant's operational costs and economic benefits, help students develop sound values and professional ethics.

5.2. Case Study II: Analysis of Technological Innovation in Water Pollution Control

Learning Objectives: By analyzing case studies of technological innovation in water pollution control, students will understand development trends and innovative approaches in this field, fostering their innovative thinking and practical skills. Concurrently, students will be guided to recognize China's achievements in water pollution control, enhancing their patriotic spirit and national pride.

Teaching Process: Select representative domestic and international case studies of technological innovation in water pollution control, such as China's "sponge city" initiative and Germany's wastewater treatment plant upgrades. Organize students into groups to analyze these cases, examining the principles, methods, and outcomes of technological innovation. Facilitate group discussions to analyze China's strengths and weaknesses in technological innovation for water pollution control and propose improvement recommendations.

Identifying Ideological and Political Elements: During case analysis, guide students to recognize China's achievements in technological innovation for water pollution control, fostering patriotism and national pride. By examining the critical role of technological innovation in environmental protection and social development, cultivate students' correct values and innovative spirit.

6. Teaching Practice and Outcomes

6.1. Teaching Practice

During the 2024-2025 academic year, an OBE-based course-based ideological and political education reform was implemented in the Water Pollution Control Engineering course for the Environmental Science and Engineering major at Chengdu Technological University. By establishing a course-based ideological and political education system and designing diverse teaching methods and case studies, ideological and political elements were organically incorporated into course instruction. During instruction, emphasis was placed on enhancing student engagement and practical skills. Through group discussions, field research, and case studies, students gained firsthand experience in recognizing the critical importance of environmental protection.

6.2. Teaching Outcomes

Student Feedback: Through questionnaires and student responses, students generally believe that the course-based ideological and political education reform has enhanced the

appeal and impact of the curriculum. While acquiring professional knowledge, they have developed sound values and a sense of social responsibility. Students' sense of responsibility and mission toward environmental protection has significantly increased, and their interest in water pollution treatment technologies has also grown.

Teaching Evaluation: A diversified evaluation system comprehensively assesses students' knowledge mastery, course-based ideological and political literacy, and overall competence. Results indicate improved course performance and comprehensive qualities compared to previous years, particularly in course-based ideological and political literacy, where students demonstrate heightened social responsibility and innovative spirit.

Faculty Feedback: Instructors have also observed positive impacts from the course-based ideological and political education reform during teaching. By identifying ideological and political elements within the curriculum, faculty members have enhanced their own ideological awareness and teaching capabilities. Simultaneously, diversified teaching methods and case designs have increased classroom interaction and engagement, thereby improving teaching effectiveness.

7. Summary

Guided by the OBE concept, integrating course-based ideological and political education into the Water Pollution Control Engineering course has not only enhanced students' mastery of professional knowledge but also successfully woven elements such as social responsibility, professional ethics, and ecological awareness throughout the entire teaching process. This approach achieves the dual objectives of knowledge transmission and value guidance.

In future teaching practices, the course-based ideological and political education reform grounded in the OBE concept requires continuous refinement. Firstly, it is essential to further explore the distinctive characteristics of the water pollution control engineering discipline, integrating more ideological and political elements such as ecological perspectives and social responsibility into teaching content to develop a more systematic instructional design. Secondly, it is necessary to explore more modern teaching methods, such as big data analysis and AI-assisted teaching, to further enhance teaching effectiveness. Additionally, course-based ideological and political education cases should be designed with greater specificity, addressing environmental issues across diverse regions and cultural contexts. This ensures teaching content remains relevant to students' realities and serves societal needs. Through continuous refinement of methodologies and accumulated experience, course-based

ideological and political education would play an increasingly significant role in applied undergraduate universities. This approach will foster the development of high-caliber engineering professionals who possess both solid technical expertise and a profound sense of national pride and social responsibility.

Acknowledgments

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