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Design and Practice of Ideological and Political Education of Environmental Engineering Principles Course Based on OBE Concept

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Abstract: The purpose of this article is to explore the design and practice path of ideological and political education (IPE) of environmental engineering principles course based on OBE concept, so as to realize the organic integration of professional courses and IPE. In this article, a systematic IPE design of the course of environmental engineering principles is carried out, and it is verified through teaching practice. The results show that the teaching design can improve students' professional literacy and ideological literacy, and cultivate their environmental awareness and social responsibility. Furthermore, we also found that the integration of instructional content and some ideological elements is not close enough, and instructional methods and means need further innovation. In view of these problems, this article puts forward corresponding improvement suggestions and looks forward to the follow-up research direction. This research is of great practical significance for promoting the connotative development of tertiary education and realizing the deep integration of professional courses and IPE.

1. Introduction

In today's society, tertiary education not only pays attention to imparting professional knowledge, but also increasingly emphasizes the cultivation of students' ideological and political quality and moral accomplishment [1]. As an important course in the field of environmental science, the principles of environmental engineering is closely related to social hot issues such as environmental protection and sustainable development, and has natural IPE resources [2-3]. However, how to effectively integrate IPE into professional courses and realize the organic unity of knowledge imparting and value leading is a major challenge facing tertiary education at present [4]. Based on this, this study puts forward the design and practice of IPE of environmental engineering principles course based on OBE concept, aiming at exploring a new teaching mode to better realize the deep integration of professional courses and IPE.

In recent years, scholars have done a lot of research on curriculum IPE, and put forward many useful instructional methods and strategies [5]. Furthermore, OBE concept, as an advanced educational concept, has been gradually introduced into the field of tertiary education and has been applied in some courses [6]. However, there is relatively little research on the combination of OBE concept and the ideological and political course of environmental engineering principles, especially the lack of systematic teaching design and practical exploration. Therefore, this study has certain innovation and practical significance.

The main purpose of this study is to explore the IPE design and practice path of environmental engineering principles course based on OBE concept, in order to realize the organic integration of professional courses and IPE and improve students' professional quality and ideological and political quality. The research contents mainly include: analyzing the core ideas and characteristics of OBE concept, clarifying the nature and objectives of the course of environmental engineering principles, discussing the connotation and requirements of IPE in the course, and the specific strategies and methods for designing and practicing IPE in the course of environmental engineering principles based on OBE concept.

2. An overview of the course of OBE concept and environmental engineering principles

OBE concept is the result-oriented education, which is an educational concept oriented to students' learning results [7]. It emphasizes that the goal of teaching design and teaching implementation is the final learning achievement of students through the educational process. The principles of environmental engineering is an important basic course in the field of environmental science, which mainly studies the basic principles and methods of the generation, transformation and control of environmental pollutants [8]. This course has the characteristics of strong theory, strong practice and strong application.

Curriculum IPE refers to an educational concept and practice mode that integrates IPE into professional curriculum teaching. It is of great application value to introduce OBE concept into curriculum IPE. First of all, the OBE concept emphasizes student-centered and pays attention to students' needs and development, which helps to better realize the educational goal of curriculum IPE [9]. Secondly, the OBE concept pays attention to the clarity and measurability of the results, which is helpful to the assessment and improvement of the IPE effect. Finally, OBE concept emphasizes continuous improvement and quality assurance, which is helpful to the long-term development and quality improvement of IPE. Therefore, the application of OBE concept to curriculum IPE is helpful to promote the connotative development of tertiary education and realize the deep integration of professional courses and IPE.

3. IPE design of environmental engineering principles course based on OBE concept

3.1. Clear teaching objectives and achievements

In the IPE design of environmental engineering principles course based on OBE concept, the first task is to make clear the teaching objectives and achievements. Focusing on the cultivation goal of applicable environmental talents with high qualities under the new engineering concept, the teaching objectives have been deepened from knowledge acquisition to the application of principles, and from cognitive ability training to engineering thinking training. Students are able to apply technical principles to analyze and solve design problems, equipment selection problems and process enhancement problems in environmental engineering, and take on the historical mission of pollution prevention and ecological civilization. The teaching objectives include the mastery of professional knowledge and skills, such as the understanding and application ability of

environmental pollution control technology, and the improvement of ideological literacy, such as the cultivation of environmental awareness, ecological civilization philosophy, social responsibility and craftsman's spirit. By making these goals concrete and measurable, we can ensure that the teaching process and results can be closely carried out around these goals, and realize the organic integration of professional knowledge and IPE.

3.2. The integration strategy of instructional content and ideological elements

According to the quality objectives of environmental engineers, six connected ideological designs are carried out to realize the organic integration of instructional content and ideological elements (As shown in Table 1). In order to form recessive educational resources with the characteristics of the environmental engineering, a series of strategies need to be adopted. First of all, the IPE resources in the course of environmental engineering principles are explored and combined with the knowledge points of the course, such as environmental polices and pollution control cases. Secondly, through case analysis and discussion, we can guide students to think about the social, economic and political factors behind environmental problems and cultivate students' ability to analyse and solve complex environmental engineering problems. Finally, the latest environmental protection policies and technological progress are integrated into the instructional content to enhance the timeliness and practicality of the course, and at the same time enhance students' environmental awareness, professional confidence and innovation ability.

Table 1: IPE Cases with Ecological Civilization Characteristics

Ideological designs	Instructional contents	Ideological elements	IPE cases
Connecting the times	Absorption	National responsibility for carbon peaking and carbon neutrality goals	Carbon capture and sequestration
	Material balance	The philosophy of ecological civilization	Garbage classification
Connecting the world	Fluid conveying machines	The confidence in the system	China's south-to-north water diversion project
	Heat transfer materials	Scientific and technological self-confidence	Zhu Rong's Mars rover
Connecting the industry	Drying process	The mission of pollution control	Sludge resource utilization
	Absorption equipment	The spirit of Chinese scientists	Academician's story
Connecting the project	Heat transfer applications	Professional confidence	Waste-to-energy technology
	Material balance	Environmental protection and energy-saving concept	Large temperature difference long transmission heating system
Connecting the society	Hydrostatic equilibrium equation	The indomitable spirit of perseverance	Three Gorges Shiplock
	Fluid resistance	Self-dependent innovation	The windshield design of China's domestically developed C919
Connecting the people	Distillation	Craftsman's spirit	Cracking the neckline of technology
	The equation of continuity	Innovation spirit and the indomitable spirit of perseverance	King Yu combating the flood

3.3. Innovation of instructional methods and means

In instructional methods and means, we need to innovate constantly to meet the requirements of OBE concept. New teaching modes such as BOPPPS teaching model and mixed teaching can be adopted to increase students' autonomous learning and cooperative learning time and improve learning efficiency and effect. Furthermore, advanced instructional methods such as multimedia technology and virtual simulation are used to create vivid teaching situations and enhance students' interest in learning and experience. In addition, experts and business representatives in the field of environmental protection can be invited into the classroom to broaden students' horizons and enhance their cognition and career planning ability in the environmental protection industry through lectures and seminars. Table 2 gives examples respectively:

Table 2: Examples of Innovative Teaching Methods and Means Based on OBE Concept

Innovative Teaching Methods and Means	Examples
Application of New Teaching Modes	1. BOPPPS Teaching Model: Student-centered, favoring the coherence of 'curricular objectives - teaching and learning activities - evaluation'. Starting and ending with solving practical engineering problems through the participatory learning line of 'discovery - exploration - application', strengthening students' engineering thinking.
	2. Blended Learning: Combine the advantages of online and offline teaching, offering diverse learning resources and activities online, while emphasizing face-to-face interaction, discussion, and practice offline to achieve a blend of personalized and deep learning.
Utilization of Advanced Teaching Tools	1. Multimedia Technology: Use images, audio, videos, and other multimedia elements to create engaging teaching scenarios, making abstract environmental engineering principles intuitive and easy to understand, and enhancing students' interest and learning experience.
	2. Virtual Simulation Technology: Simulate real environmental engineering scenarios or processes through virtual simulation software or platforms, allowing students to conduct experiments, operations, or simulations in a virtual environment to improve their practical skills and problem-solving abilities.
Integration of Industry Experts into the Classroom	1. Lectures by Experts in Environmental Protection: Regularly invite experts and scholars in environmental protection to give lectures or share insights on current environmental hotspots, technological frontiers, or policy trends, broadening students' perspectives and enhancing their professional understanding.
	2. Seminars with Corporate Representatives: Collaborate with companies to invite corporate representatives into the classroom for seminars or exchanges on the current status of the environmental protection industry, corporate demands, career planning, etc., helping students understand industry realities and enhancing their career planning abilities.

3.4. Construction of teaching assessment and feedback mechanism

In order to ensure the teaching effect and quality, it is needed to construct a scientific teaching assessment and feedback mechanism. This includes the establishment of a diversified assessment system, which includes students' mastery of professional knowledge, the improvement of ideological literacy, and the ability to innovate and practice. Furthermore, the combination of process assessment and result assessment is adopted to attach importance to both students' learning achievements and their performance and progress in the learning process. As shown in Table 3:

Table 3: Teaching Assessment and Feedback Mechanism

Assessment Dimension	Assessment Content	Assessment Method	Feedback Mechanism
Professional Knowledge Mastery	Students' grasp of core concepts, theories, calculation methods, and application techniques in the Environmental Engineering Principles course	Closed-book exams, homework assessments, in-class quizzes	Regularly provide feedback on exam and homework grades, offer individual tutoring and group explanations for errors
Ideological and Political Quality Improvement	Students' enhancement in environmental awareness, social responsibility, professional ethics, etc.	Surveys on the integration of ideological elements in the course, group discussion performance, classroom participation	Collect student feedback through surveys and observations, adjust strategies for integrating ideological elements, enhance classroom interaction
Innovative Practical Ability	Students' ability to solve practical problems, engage in scientific research and innovation, participate in practical activities, etc.	Experiment reports, project designs, innovation competition results, practical activity reports	Showcase outstanding works, encourage students to share experiences, provide practical guidance and resource support
Overall Performance	Students' learning attitude, teamwork ability, communication and expression skills, etc.	Classroom observations, group assignment assessments, peer assessments	Provide regular one-on-one feedback to students, offer personalized development suggestions, promote overall development

By establishing an effective feedback mechanism and collecting the opinions and suggestions of students and teachers in time, the personalized assistance can be carried out and the teaching design can be continuously improved and optimized.

4. Based on the OBE concept, the IPE practice of environmental engineering principles course

In teaching practice, the selection and design of teaching cases is the key link. Typical pollution prevention and control projects, such as urban sewage treatment, solid waste resource utilization and air pollution control, are selected to build an environmental engineering case base. Through the introduction and analysis of cases, students are guided to deeply understand the application of environmental engineering principles and cultivate their ability to solve practical problems.

In the process of classroom teaching, attach importance to the infiltration of ideological elements. Teachers guide students to attach importance to the development and challenges of national environmental protection by explaining environmental protection laws and policies. Furthermore, value guidance is carried out by combining the knowledge points of the course, such as emphasizing its contribution to ecological civilization construction when explaining pollution control technology. In addition, through classroom discussion, group debate and other forms, students are guided to think deeply and communicate on environmental protection topics, and their critical thinking and environmental awarenessare cultivated. Practice teaching is an important part of the course of environmental engineering principles, and it is also an important link in IPE. By organizing field trips, environmental monitoring and other practical activities, students can experience the actual process and challenges of environmental protection work. In practice, guide students to think about how to apply what they have learned to solve practical problems and cultivate their innovative thinking and practical ability. Furthermore, it also cultivates students'

teamwork spirit and sense of social responsibility through teamwork and division of responsibilities in practical activities.

In order to evaluate the teaching effect and quality, students' learning effect is evaluated regularly and analyzed by feedback. By collecting students' homework, test scores, practice reports and other data, analyze students' performance and progress in different aspects. Furthermore, students' learning attitude and participation are also included in the assessment to comprehensively evaluate the teaching effect. The assessment results of teaching effectiveness are shown in Table 4.

Table 4: Assessment Results of Teaching Effectiveness in Environmental Engineering Principles Course

Assessment Indicator	Assessment Content	Excellent Rate	Good Rate	Moderate Rate	Pass Rate	Fail Rate
Professional Knowledge Mastery	Homework completion, test scores	36.9%	28.6%	14.9%	12.5%	7.1%
Ideological and Political Quality Improvement	Environmental awareness, social responsibility performance	45.2%	33.3%	13.1%	3.6%	4.8%
Innovative Practical Ability	Quality of practical reports, demonstration of innovative thinking	31.0%	21.4%	15.5%	15.4%	16.7%
Learning Attitude and Participation	Classroom participation, homework submission	59.5%	28.6%	5.9%	2.4%	3.6%
Team Collaboration Ability	Teamwork performance in practical activities	32.1%	35.7%	21.4%	6.0%	4.8%

Analysis of tabular results: The teaching effect of the course of Principles of Environmental Engineering is generally good, and students' professional knowledge, ideological literacy, learning attitude and participation, and teamwork ability have all been improved. However, some students need to be further strengthened and improved in the innovative and practical ability. Therefore, teachers should continue to attach importance to students' learning situation in the follow-up teaching, and provide personalized guidance and help according to the needs of different students, so as to further improve the teaching effect and quality.

5. Conclusions

Based on the concept of OBE, this study carried out IPE design and practical exploration on the course of environmental engineering principles. The organic integration of professional courses and IPE has been realized by defining teaching objectives and achievements, integrating instructional content with ideological elements, innovating instructional methods and means, and constructing teaching assessment and feedback mechanism. Teaching practice shows that the teaching design can effectively improve students' professional quality and ideological and political quality, cultivate their environmental awareness and social responsibility, and achieve the expected teaching effect.

Although some achievements have been made in this study, there are still some problems and shortcomings. In view of the existing problems and deficiencies, the follow-up research will further deepen the integration strategy of instructional content and ideological elements, explore more diversified instructional methods and means, and improve the teaching assessment and feedback mechanism. Furthermore, we will also attach importance to the latest development trends in the field of environmental engineering, and integrate new technologies and concepts into the course teaching to enhance students' innovative ability and practical ability.

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