

## Optimizing the Teaching Content of “Introduction to Environmental Engineering” in Petrochemical Fields in Institutions of Higher Education

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### Abstract

For “Introduction to Environmental Engineering” to be truly useful in various professional petrochemical fields in general colleges and universities, it is important to motivate non-environmental engineering students to gain environmental science and engineering-related knowledge and improve the quality of teaching in such a course. In this paper, we focus on strengthening the connections between the teaching content of this course and students’ majors and future work, because most students in petrochemical studies in institutions of higher education will be engaged in work related to oil and gas field production and refining. We also discuss building a stronger team of teachers.

### Keywords

**Introduction to Environmental Engineering; Subject characteristics; Teaching reform.**

### 1. Introduction

For undergraduate students in regular institutions of higher education in the petrochemical fields, the role and importance of the Introduction to Environmental Engineering course is gaining prominence. It not only provides the necessary basic knowledge of environmental science and engineering for the professional growth of students from other majors but also undertakes the task of cultivating students’ awareness of environmental protection, their sustainable development literacy, and the ability to learn and apply environmental science theory and engineering technology [1].

However, most of the teaching content of introductory environmental engineering courses is centered on a basic knowledge of environmental science and engineering together with basic methods of environmental pollution control, studying cases of environmental pollution and control with environmental impact assessment-related content. Furthermore, there is very little content about oil and gas fields; refining, and chemical environmental pollution control-related technologies, theories, and cases; environmental pollution and safety production laws and regulations; and other content [2]. This makes students think that the Introduction to Environmental Engineering course is less related to their majors and future work, resulting in reduced motivation and loss of interest in taking this course [3].

In view of the issues above, the author proposes to adjust the teaching content of this course to meet the development needs of students of different majors according to their respective subjects as well as students’ future work characteristics and further improvement

requirements [4]. This paper also discusses the characteristics of the profession and how to build the teachers' team, considering the teaching practice and experience of this course in colleges and universities.

## **2. Understanding the Characteristics of Different Professions and the Needs of Students for Employment and Further Development and Optimizing the Teaching Content**

Introduction to Environmental Engineering has always been an introductory course for non-environmental engineering students in colleges and universities; this course is the cumulative effort of several generations of teachers, and has created a solid foundation in teaching [5]. However, in China, the Introduction to Environmental Engineering is offered as a course in the first semester of the fourth year of university, when students have a certain understanding of their major after one year of field-related course studies, and they have a clearer plan for their future work and further development [6].

Therefore, if only basic knowledge of environmental science and engineering is taught in this course, together with basic methods of environmental pollution control technology, environmental pollution and control cases, and environmental impact assessments, students will find the content rather boring and less related to their future work and will lack the motivation to learn. To address this problem, lecturers should not only master the basic knowledge of environmental science and engineering but also understand the professional content and direction of future development of their students. They can only teach an Introduction to Environmental Engineering course well if it is based on the students' majors and their future industries; takes into account the characteristics of their different majors and industries; teaches general knowledge of environmental engineering, which can strengthen the close relationship with professional knowledge; connects environmental engineering with various majors in teaching; highlights the characteristics of the majors; synergistically combines theoretical knowledge with professional knowledge; and helps students in different majors realize the importance and necessity of studying Introduction to Environmental Engineering, mobilizing students' learning enthusiasm and cultivating their interest in learning [7].

## **3. Optimizing Teaching Content According to the Characteristics of Students' Professional Backgrounds**

To increase environmental engineering knowledge in each professional field, mobilize the initiative of students with different professional backgrounds to learn Introduction to Environmental Engineering, and improve teaching quality, it is necessary to break the original unified teaching mode, arrange teaching contents according to the needs of different majors for environmental engineering-related theories from the training objectives of each major, and optimize and adjust the focus of teaching content according to subject characteristics.

### **3.1. Keeping up with the Times and Updating the Teaching Content**

The traditional teaching of Introduction to Environmental Engineering is characterized by a great deal of textbook content but few hours. The traditional teaching process usually focuses on the basic theory and knowledge of environmental science and engineering while overemphasizing the teaching of environmental science and engineering. It seldom introduces its connection to other disciplines or explains how to use the environmental science and engineering theories learned and the sustainable development awareness gained, in order to address practical problems in daily life—in petrochemicals, geological exploration, oil and gas storage and transportation, material applications, and other disciplines.

As a result, although students have some environmental theoretical knowledge, they do not know how to use it to solve practical problems, resulting in a disconnect between environmental engineering knowledge, students' professional knowledge, and their future development needs, which leads to students' loss of interest in learning. Therefore, the reform of the Introduction to Environmental Engineering course is focused on optimizing the teaching content so that students can learn basic theory, gain knowledge while improving their ability to analyze and solve problems, and cultivate their innovative awareness, thinking, and ability [8].

### **3.2. Highlighting Subject Characteristics and Focus of Teaching Content**

To better utilize the Introduction to Environmental Engineering course in various professional fields, stimulate students' enthusiasm and initiative in learning the course, and improve teaching quality by understanding the students' subject background, we recommend that teachers optimize the teaching content to be in line with the basic requirements of the Introduction to Environmental Engineering syllabus, adjust the teaching focus according to specific profession characteristics, and stay dedicated to applying the basic theory and knowledge of environmental science and engineering to the profession. This requires teachers to not only focus on teaching the basic knowledge of environmental science and engineering but also introduce the environmental science and engineering technology related to students' majors and explore the frontier and the heated issues of interdisciplinary subjects, so that students can clearly understand the importance of environmental science and engineering in the industry in which they will be engaged in the future.

We suggest actively introducing new ideas and methods in the frontier fields of the discipline, appropriately introducing the development of interdisciplinary subjects such as environmental engineering and petroleum engineering, geological exploration, and environmental science; focusing on the penetration of environmental engineering and other sciences; and improving the comprehensive quality of environmental protection and governance for students [9]. For example, when teaching environmental engineering to petroleum engineering students, they can focus on the environmental pollution hazards in the process of petroleum exploration, extraction, gathering, transmission, and refining, as well as treatment ideas and technologies to deal with the generated oily sewage, oily sludge, and VOCs, while explaining the differences between this treatment and the treatment of industrial pollutants in other industries. Students will understand and master the basic concepts and characteristics of hazardous waste together with other basic knowledge and will strengthen their thinking on the laws and regulations of environmental protection and governance. For students studying materials, the importance of the application of green materials for environmental protection and its impact on later governance technology can be highlighted, so that they can enhance their awareness of environmental protection during the process of materials development and application to abate pollutants at the source. At the same time, during the lecture, the teaching of laws and regulations and cases of safe production and environmental pollution are added to help students understand the relationship between safe production and environmental pollution and the possible impact on individuals and collectives. With relevant examples, students can have an enhanced understanding of environmental science and engineering and an increased horizontal connection between subjects, which increases interest in learning [10].

This will enable students to feel that their learning is truly useful—that it enlightens their thinking, cultivates their innovative qualities, and gives full play to the role of the Introduction to Environmental Engineering course in cultivating innovative talents.

#### 4. Establishing A High-Quality Faculty for the Introduction to Environmental Engineering Course

Teachers are the major factor in teaching, and only a team of high-quality teachers can cultivate students with high qualities [11]. Therefore, building a teaching team with high levels of teaching and scientific research in the Introduction to Environmental Engineering course is the primary task of teaching reform for this course, which can be carried out in the following steps: 1) by improving teachers' responsibility, as only high quality teachers will be fully responsible for their students and have real enthusiasm for their teaching work; 2) by improving teachers' academic levels, and improving their comprehensive abilities with scientific research and discipline-building work, as only teachers with high academic levels in their own research field can grasp the heated and frontier issues of research and give students information closely related to environmental science and engineering, to boost students' ability to learn expansively and draw inferences; 3) by adopting various teaching forms and methods such as classroom teaching, multimedia teaching, experiments, field internships, course Q&As, and so on, to stimulate students' study interests comprehensively; 4) by taking into account different majors, since appropriately increasing the experiments related to environmental engineering and other majors while completing basic experimental teaching can not only provide environmental engineering knowledge and experimental skills but can also deepen students' understanding and mastery of environmental pollution control technology and enhance the status of environmental engineering in their minds; and finally, 5) by strengthening teachers' ties with companies in this field, and gaining a full understanding of the petroleum and petrochemical production process and the demand for environmental protection through regular research, internships, and off-the-job work, so they can purposefully combine the theory and knowledge of environmental protection with oil and gas field production and improve students' application ability and interest in learning.

#### 5. Conclusion

We can reform the teaching of the Introduction to Environmental Engineering course by changing the previous mode of teaching the same content to students in multiple majors and instead adjusting the teaching content according to the characteristics of students' respective majors, thus cultivating students' interest in learning, while building a stronger faculty team and improving teachers' comprehensive quality to improve their teaching ability.

#### Acknowledgments

The work was supported financially by National Science and Technology Major Project of China (2017ZX05069004), Shaanxi Provincial Key Research and Development Program (2019ZDLGY06-03) and Education Innovation Project of Xi'an Shiyou University (2019-23). And we thanks the work of Modern Analysis and Testing Center of Xi'an Shiyou University.

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