

Research on Integrated Teaching of “Air Pollution Control Engineering” Course System

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Keywords: Integrated teaching; Classroom teaching; Experimental teaching; Enterprise practice; Course design

Abstract: There are many knowledge points in air pollution control engineering, which has the characteristics of multi-disciplinary integration and rapid content updating. The development of society puts forward higher requirements for teaching methods and means. Faced with the new situation and new requirements, we actively explored and innovated, and proposed the “classroom teaching + experimental teaching + enterprise internship + course design” model, through the organic combination of theory and practice, in order to achieve better teaching results.

1. Introduction

“Air Pollution Control Engineering” is a professional main course of environmental engineering. The teaching key points of this course is how to improve the teaching methods inside and outside the classroom so that students can systematically understand and master the professional knowledge of air pollution control engineering, and exercise the ability to analyse and solve air pollution problems [1].

At present, the course focuses on theoretical teaching. The following problems are common in teaching content and teaching methods: (1) There are many concepts and formulas needing to be mastered in the course. The principles involved are Abstract. The existing traditional teaching methods are less intuitive, which affect the teaching effect. (2) The teaching mode is injection teaching, and the interactive mode is rather dull, which can not fully mobilize the enthusiasm and initiative of students in learning. (3) There are fewer channels for students to know the most updated information in relevant fields. (4) The training of students' experimental operation and application abilities according to course content is insufficient. These problems ultimately affect the teaching effect, resulting in students' comprehensive ability not being effectively trained and exercised.

In this century, the demand for talents is changing from knowledge-based to skill-based and application-oriented. How to adapt the teaching of the main course of environmental engineering to the new changes and needs of society is particularly important. This paper aims at exploring and improving the teaching mode of air pollution control engineering. Adopting the combination of theory with practice, it combines classroom teaching with experiment teaching, enterprise practice and course design from content to order, which can help to improve the teaching quality, strengthen the cultivation of students' skills of engineering practice, and lay the necessary foundation for students to engage in air pollution control engineering design and technical management after graduation. The proposed teaching mode provide reference and guidance for other colleges and universities to train relevant talents.

2. Classroom Teaching

Classroom is an important position for cultivating students' creative thinking and the main place for students to acquire knowledge. 80% of students' time and energy are spent in the classroom. To this end, we must innovate in teaching methods, being transformed into heuristic education to stimulate students' creative potential [2].

2.1 Combining Theory with Practice

The content of “air pollution control engineering” course is closely related to practical engineering application. According to the characteristics of this course, we can adopt the teaching method of combining theory with practice to improve students' interest in classroom learning and cultivate students' ability to analyze and solve problems with the theoretical knowledge they have learned. For example, when explaining the content of “calculation of pollutant source intensity”, the source of combustion pollutants such as particulates, sulfur oxides and nitrogen oxides in the chapter “Combustion and atmospheric pollution” can be explained, and the course content of “control technology of particulate pollutants” can be further introduced, so that students can choose purification devices on the basis of fully mastering the characteristics of particulates [3]. Through the connecting with the enterprises to utilize the information provided by the enterprises such as flue gas flow, concentration of flue gas pollutants, wind speed, flue gas exit temperature, chimney height and inner diameter to calculate the flue gas lift height, combined with the local urban planning demand, students can assess the impact of air pollutants emitted by enterprises on the surrounding environment. This kind of classroom teaching method can mobilize the enthusiasm of students to learn and train their ability to apply knowledge.

2.2 Sharing Research Progress at Home and Abroad with Students through Social Platforms

Air pollution has a negative impact on climate, environment, health and other aspects. It has attracted great attention from government departments, the public and scientific and technological personnel. The pollution mechanism, pollution source analysis and control technology have made rapid progress. This puts forward higher requirements for classroom teaching, needing to keep pace with the times and teach new theories and techniques. Because of the time limitation of classroom teaching, the knowledge taught can not comprehensively cover the trends and hot spots of air pollution control technology at home and abroad in recent years. In view of the development of modern social communication technology, it is more and more common to obtain all kinds of information from the Internet, and it is more timely and effective to exchange and share information on social platforms. Teachers can make full use of informational and modern teaching methods, share and discuss research progress at home and abroad through social platforms commonly used by young people such as WeChat and QQ. Integrating the frontier knowledge of the discipline into the teaching content can broaden the knowledge of students and cultivate their innovative consciousness and ability [4].

2.3 Using Multimedia Assisted Instruction to Stimulate Students' Interest

Multimedia teaching integrates text, image, sound, animation and video. Its intuitive and vivid image can stimulate multiple senses of students to participate in cognition [5]. Multimedia-assisted teaching can activate classroom atmosphere, stimulate students' interest and imagination, promote students' understanding of knowledge, and thus help to improve teaching efficiency. For example, when explaining air pollution problems such as smog, relevant pictures, news reports, documentaries and other content can be combined to explain, and students can be organized to discuss, so as to enhance the interaction of the classroom [6]. In explaining the dedusting equipment such as electrostatic precipitator and bag filter, the FGD process such as limestone-gypsum method, and the flue gas denitrification process such as SCR and SNCR, a large number of more intuitive materials such as pictures of the equipments and technical animations can be displayed. A fuller and deeper understanding of the appearance, structure, and size of various flue gas treatment equipments can be achieved, being conducive to the subsequent course design. At the same time, multimedia-assisted teaching can also supplement and expand the classroom teaching content to expand the amount of information transmission, systematically expound the scattered knowledge points to students to form a knowledge network, optimizing the classroom teaching structure.

2.4 Innovation of the Form of Peacetime Assessment

The classroom assessment can take simpler and more motivating forms. For example, using

shared small program to randomly select students' number to answer questions can enhance the interest of the classroom. According to the key points to be mastered in the classroom, using the questionnaire platform to conduct time-limited tests, students can scan code with mobile phones to complete the answer. At the end of the test, the students can get their own scores immediately to know their mastery of relevant knowledge. The teacher can also immediately obtain relevant statistical data, and explain in class according to students' mastery of the assessment knowledge points. These methods can fully mobilize the enthusiasm of students, make students more focused in the classroom, and help improve their learning efficiency.

3. Experimental Teaching

Experiment is an important part of the teaching process. Combining the textbook knowledge with experimental teaching can train students to use the theory they have learned to analyze and solve problems [7]. For example, in the cyclone dust collector experiment, the dust removal efficiency of the collector can be directly determined through the testing equipment, and can also be obtained through theoretical calculation. The comparative analysis of the two methods consolidates the classroom knowledge and effectively combines the theory with the practice [8]. In addition, the traditional practice teaching is mostly confined to the confirmatory experiment. The practical teaching methods can be studied and explored to set up more exploratory experiments to give students more opportunities to independent thinking and practice.

3.1 Enterprise Internship

Enterprise practice is an important practical teaching section for science and engineering specialities. After classroom teaching and experimental teaching, students' abilities can be further improved through enterprise practice. Teachers or engineers with rich practical experience can be invited to lead students to enterprises with advanced atmospheric environmental protection equipments to visit the flue gas treatment process and learn the basic principles and processes of flue gas treatment, equipment layout, handling capacity, purification efficiency, energy consumption, etc., to achieve the organic combination of theoretical knowledge and engineering practice [9]. By letting students compare and analyze “What is the advanced technology of different companies? What is the principle? Why does the flue gas not meet the emission standards? Is there any measure or technology to solve or improve?” during the internship process to improve students' ability of analysis and innovation of combining theory and practice.

3.2 Course Design

One of the current problems in this course is how to develop students to change theoretical knowledge of textbooks into ability of solving engineering problems. Through practice, students master the practical engineering application knowledge, and then carry out course design, which can consolidate classroom knowledge, improve professional skills, and lay the foundation for future design work. The main contents of course design include engineering design calculation, equipment selection, process design, technical and economic analysis, drawing, etc. The course design can be carried out from the following aspects: (1) Selecting the topic. The topic of course design should be derived from the actual production and life, such as coal-fired power plants and heating boiler houses; (2) The preparation of the Course Design Task Book and the Course Design Guide. The scientific course design task book and instruction book can guide students to successfully complete the course design work reasonably; (3) Teacher's guidance. The teacher's guidance in the design process should be heuristic, guiding the students to think and implement independently [10].

4. Conclusions

This paper puts forward the integrated teaching mode of “classroom teaching + experimental teaching + enterprise internship + course design” in air pollution control engineering course. The principles, theories, and the main points of design calculations taught in this course are important

foundations in teaching. Multimedia and some platforms are used in classroom teaching to enhance students' enthusiasm, increase interest and interaction, and ensure high efficiency mastery to classroom knowledge. After mastering the theory, the experimental teaching will enable students to turn theoretical knowledge into practical hands-on ability and accumulate practical experience. Combining with enterprise internships to let students touch the skillful application of knowledge in daily production process, heuristic and participatory teaching methods are implemented. Finally, course design is carried out to complete the comprehensive investigation task of this course, and to cultivate students' ability to think positively, innovate bravely and find new ideas and methods. This mode is more conducive to training students to become senior engineers and technicians with solid foundation, broad knowledge and innovative ability.

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