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Design and Application of Informatization Teaching of "Air Pollution Control Engineering" Course Based on Enterprise Real Project Tasks--Taking the Selection of Cyclone Dust Collector as an Example

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ABSTRACT. *Professional development needs to be deeply integrated with enterprises, and bringing real project tasks of enterprises into the teaching process is an important teaching mode and means for the course of "Air Pollution Control Engineering". It is very beneficial for students to adapt to the requirements of their positions and companies in the future by designing the teaching process in the "real" teaching mode. Combining information-based teaching methods, enhancing online and offline communication and interaction between teachers and students, improving students' practical skills, and developing new requirements and tests for our vocational education in the development of our times.*

KEYWORDS: *Informationization; Teaching design; Cyclone dust collector; Selection*

1. Introduction

Air Pollution Control Engineering" is a core and main course of environmental monitoring and control technology major. It is an important part of practical teaching. However, in the long-term teaching practice, it is found that the theoretical knowledge of teaching materials and the actual work of the company are severely disconnected from each other. To make students enthusiastic about learning, the learning effect of this course is not ideal. In this case, by using the basic principles of the project teaching method in practical teaching, combined with the training goals of higher vocational colleges, trying to introduce the real work project tasks of enterprises, creating a "real working state" teaching mode, allowing students to simulate the actual situation Operational work status, combined with the aid of information-based teaching methods, realize the combination of mixed teaching methods. The effective combination of learning knowledge and work tasks forms an organic knowledge framework that can change the type of machine learning that students memorize, improve students' interest in learning, and allow students to fully exercise their ability.

2. Meaning of Teaching Tasks

The content selected in this teaching task is a common problem that all kinds of pollutant-emitting enterprises have to face, the discharge of dust pollutants. Dust pollution directly threatens people's lives, especially in dust-contaminated environments, which can cause a variety of cardiovascular and respiratory diseases. Cyclone dust collector is a necessary dust removal equipment for enterprises such as cement plants and coal-fired plants to achieve compliance with emissions standards. If improperly selected, there will be problems such as low dust removal efficiency, blocked or unusable cyclones.

3. Teaching Analysis

3.1 Analysis of Teaching Basics

This teaching unit comes from the course of "Air Pollution Control Engineering". It is selected from the "Air Pollution Control Engineering" published by the National Twelfth Five-Year Plan Textbook Higher Education Press; it is selected from Task 2 of Project 2 Particulate Pollutant Control. Need 2 During the class, the teaching target is students in the fourth semester of environmental monitoring and control technology. They have

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mastered the classification of dust removal equipment and basic knowledge of dust; the teaching location is the integrated training room for rationality and practicality.

3.2 Analysis of Teaching Content

In actual work, if we want to choose a suitable dust collector for the smoke and dust emission enterprises, we first need to understand their dust composition and dust removal requirements, and based on this, we can initially determine which type of dust collector is suitable on the market. After selecting the large category, the specific size of the equipment must be calculated, the specific specifications and models should be selected according to the size parameters, and the selection results should be checked and corrected. In the selection process, the calculation of key component sizes is the basis for determining the specifications and models, so it is the focus of this lesson. After completing the selection, it is necessary to use a large number of parameters and formulas to check and correct its dust removal efficiency. Due to the weak computing ability of the students, it is very challenging to implement this process. Therefore, the correction after the selection is this time. Difficulties in teaching.

3.3 Analysis of Teaching Objectives

According to the professional requirements of smoke and dust treatment technical positions, students in this class should complete the following teaching goals:

(1) Knowledge Target

1) Understand the structure and composition of cyclone dust collector;

2) Grasp the size calculation of cyclone dust collector;

3) Grasp the check of dust removal efficiency of cyclone dust collector.

(2) Capability Goals

1) A reasonable choice of the inlet air speed can be made;

2) Can make reasonable selection of dust collector specifications;

3) The equipment selection can be checked based on the composition of the dust.

(3) Quality Goals

1) Develop a rigorous and rigorous work attitude;

2) Develop a habit of careful analysis and careful inspection.

3.4 Analysis of Students' Academic Situation

Existing cognition: Through the prerequisite courses such as “Environmental Engineering CAD and Mapping”, students already have the ability to identify equipment structures; in the previous tasks of this teaching project, students have mastered the particle size and distribution of dust, The nature of dust, the classification and performance of dust collectors, have some understanding of dust removal equipment.

Learning characteristics: Students are very enthusiastic about the Internet, using information platforms to break through the traditional teaching time and space limitations, real-time communication and interaction, students are afraid of complex calculation formulas and selection processes, and need to use information technology to improve their calculation and selection capabilities Lack of engineering experience in dust collector selection, and the ability to interface with corporate posts needs to be improved.

3.5 Analysis of Teaching Resources

1) Information Resources: Smart Vocational Education Cloud Platform, Cloud Classroom, 3d Animation, Micro-Lessons, Pictures.

2) Software Resources: Self-Designed Calculation Software, and Virtual Simulation Software Developed in Cooperation with Schools and Enterprises.

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3) Environmental Resources: Campus Environment Covered by Wireless Network, Equipped with Computers, Physical Teaching Aids and Touch Screen Tv

Integrated training room, such as rational and practical, supports mobile learning, assessment and teacher-student interaction.

4. Overall Teaching Design

4.1 Teaching Path Design

This course is selected from the teaching item 2 “Pollution Control of Particulate Pollutants” in the core course “Air Pollution Control Engineering” of Environmental Engineering Technology, and the task 3 “Selection of Cyclone Dust Collector”. It takes 2 hours to adopt project-based teaching. The task is derived from the actual needs of the company and is a necessary skill for the flue gas processing post. The task is implemented in accordance with the work process of “demand analysis → preliminary judgment of the type → size calculation → specification selection → check correction”.

(1) The whole course adopts the flipped classroom mode. The course network platform is used to release preview and review tasks, push related micro-lessons, animations, electronic manuals, etc., and complete the structure of the cyclone dust collector, the factors affecting performance and the selection process before the lesson. Learning and evaluation of knowledge, completing more complicated cyclone duster selection tasks after class, to train students 'autonomous learning ability, and to meet students' individual learning needs.

(2) This lesson is based on the real work process and students' cognitive laws, and adopts the context-based task-driven method. In the teaching implementation process of “know the dust collector → analyze the dust collector → select the dust collector → simulate the dust collector”, inspire Students' emotional experience and learning interest, the actual introduction of XLP / B type dust collectors in class, let students select dust collectors in accordance with the real workflow, and use virtual simulation software to simulate the dust removal process. After the class, the practical tasks of the XLP / A type dust collector will be introduced to allow students to consolidate and deepen the teaching content of this course in a new round of practical application.

4.2 Information Technology and Means Design

1) Aiming at the large volume of the cyclone dust collector, the internal structure is not easy to identify, and no intuitive understanding of key components, the teacher records the micro-classes by himself, and selects the structure and principle animations to be pushed to the students through the cloud platform to complete the understanding and analysis of the dust collector structure.

2) Aiming at the tedious selection steps of the cyclone dust collector, the heavy workload of size calculation and correction, and students' prone to boredom and other problems, the self-designed calculation software that integrates the selection process, parameter query and calculation formula into one is adopted. To achieve multiple trial calculations in a short period of time, a large amount of time saved can be used for students to deepen the grasp of the rules and principles in the selection and check correction process, accumulate selection experience, and improve the accuracy of the calculation results.

3) Due to the large volume of the cyclone dust collector, it is difficult to judge the reasonableness of the selection through field testing experiments. Our school and the company have developed virtual simulation software to simulate the real working process of the dust collector and determine whether the dust removal efficiency has reached the standard.

4.3 Design of Assessment and Evaluation

The evaluation content is divided into four parts in this class: 20 pre-class test questions, including the structure of the cyclone dust collector and the factors affecting the efficiency, issued by the Smart Vocational Education Cloud Platform, accounting for 20%; Type report, accounting for 40%; use virtual software for simulation experiment operation, accounting for 20%; complete the “XLP / A type dust collector calculation and selection” assignment after the class is uploaded to the cloud classroom, accounting for 20%. Through the powerful statistical functions of the Smart Vocational Education Cloud, a variety of assessments have been achieved, and students' knowledge, skills and literacy goals have been comprehensively assessed. Through four

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stages of process diagnosis, students can use the cloud platform before, during and after class. The comprehensive statistical score of the company has been evaluated in a diversified, comprehensive, and informatized manner.

5. Teaching Implementation

5.1 Understanding the Dust Collector

During the pre-class instruction, students log in to the cloud classroom, receive teachers' task lists and related learning resources, and watch the micro-classes to master the structure and use of the dust collector. By operating simulation software, the factors affecting dust efficiency are lifted and the platform is completed Knowledge test. I check the test results of the cloud platform's automatic statistics to grasp the learning situation of students and adjust teaching strategies. At the same time, I group students according to the test results and ask each group to consult the environmental equipment design manual to complete the most common XLP / A and XLP / B Analysis report of type cyclone dust collector.

5.2 Analysis of Dust Collector

In the actual combat in the class, I analyzed the working principle of the cyclone dust collector through an animation demonstration; through the three-dimensional structure animation and the physical contrast analysis, the students were able to lift the internal and external structure of the dust collector and the specific position of the distribution of various size parameters. Students complete the analysis report and mark the size parameter map.

5.3 Selecting a Dust Collector

Students log in to the cloud classroom to read case information on the selection of a cyclone dust collector for a dust station in a thermal power station, extract key parameters such as dust composition, dust removal requirements, and fill out a selection requirements analysis form. Guide students to determine the best choice of XLP / B cyclone dust collector based on the analysis results. In the project, whether it is type A or B, there are specific specifications and models, and the specific specifications will be determined based on the calculation of air speed and size.

The determination of air speed is the basis of size calculation. The selection of this value directly affects whether the selected dust collector meets the processing requirements. Technical personnel are generally selected one by one within the airspeed experience range (12-25m / s). Because the size calculation process is very tedious, it needs to go through 18 parameters, 22 formulas, and 19 operation steps. We have designed a calculation software that integrates the selection process, parameter query, and design formula into one. The software can help students quickly grasp the selection process and calculation process. Based on this, after entering the air velocity value, students can quickly complete the calculation of the size of each component. During this period, students must judge whether certain parameters are reasonable or not, and highlight Focus on teaching. In the specification selection part of the calculation software, the diameter of the cylinder is input.

The student considers factors such as the size of the factory site and the economics of dust removal to find and select the specific specifications and models that match. The size calculation part ends here. Checking and correcting is the difficulty of this task. Checking whether the dust removal efficiency meets the standard, so as to judge the rationality of the selection. After the check fails, you need to correct the air speed again, and repeat all the previous processes. It takes a lot of time to complete, as the first time. The students who study are likely to fail the verification. The students first judge whether the value of the original imported air velocity is too large or too small based on the theoretical knowledge, and reselect and recalculate and check until it meets the design requirements. After using the calculation software, students repeatedly try to calculate the value to correct the gas velocity in a short period of time. This saves time can be used to master the rules and principles of gas velocity selection. At the same time, repeated trial calculations also accumulate the selection experience and crack the teaching. Difficult, so far, the selection of cyclone dust collector is complete. Students submit a selection report of dust collectors for thermal power stations.

5.4 Analog Dust Collector

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The simulation software is used to simulate the actual cyclone dust collector. Students enter the dust composition and dust collector parameters to verify whether the dust removal efficiency meets the standard. The system automatically determines the correct operation steps and records the score to verify the selection results. After class expansion, the calculation of XLP / A type dust collector is completed by the calculation software, the simulation software simulates the dust removal process, and the after-school exercises on the platform are completed.

5.5 Assessment

Through the powerful statistical function of the smart vocational education cloud platform, a variety of assessments have been achieved, and students' knowledge, skills and literacy goals have been comprehensively assessed. Through the four-stage process diagnosis and the comprehensive statistical scores of students on the cloud platform before, during and after class, the assessment has been diversified, comprehensive and informative.

6. Evaluation of Teaching Effect

The Cloud Platform Breaks through the Time and Space Limitations of Traditional Teaching. Teachers and Students Conduct Various Exchanges and Interactions in Real Time to Check Learning Effectiveness.

The Simulation Software Simulates the Performance Measurement and Dust Removal Process of the Dust Collector, and Solves the Problem That It is Difficult to Practice in the Field Experiment.

The Use of Video Animation Can Enhance the Analysis of the Internal Structure of the Device, Which is Real and Vivid.

The Self-Designed Calculation Software Solves the Problems of Complicated Calculation, Selection Process and Parameter Query, Which is Convenient for Students to Carry out Trial Calculation and Practice.

By comparison, in the past, 2 teachers were required to complete the selection. 6 classes, and the students completed 3 selections. Now, this class only requires 1 teacher. In 2 classes, the students can perform 6 selections. At the same time, the accuracy rate Increased from 38.2% to 96.8% now, truly achieving labor saving, time saving and high efficiency.

7. Conclusion

The optimized four teaching links are in line with the laws of cognition and realize the transformation from abstraction to concrete cognition. The use of computerized software and other information-based methods reflects the teacher's “doing teaching” and students “doing learning”. Students have accumulated engineering experience, improved selection skills, and docked with corporate positions. Information-based teaching methods have stimulated students' interest in learning and improved teaching results. Complementing the advantages of traditional and information-based teaching, while using calculation software to simplify calculations, guide students to focus more on the air speed selection rules and the selection process to achieve the best teaching results.

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