The Course Reform of “Power Plant Chemistry” under the Background of Engineering Professional Certification

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Abstract. Based on the environmental engineering professional engineering certification and double first-rate construction of North China Electric Power University, the comprehensive professional curriculum "Power Plant Chemistry" will be comprehensively reformed, from classroom teaching methods to evaluation methods, giving full play to the functions of computer simulation and adding calysis. Combined with experiment, homework and process assessment, the study guide of keyase an content has been strengthened, and the ability of students to analyze problems has been improved. The degree of achievement of the course is greater than 0.70, which can meet the requirements of the corresponding index points of graduation requirements. It laid the foundation for professional certification.

Introduction

“Power Plant Chemistry” is an important professional course for environmental engineering majors of North China Electric Power University. It is also a necessary foundation for students to work in the power system to work on chemical engineering in power plants. The course has a wide range of content and has the characteristics of fragmentary knowledge, comprehensiveness and large changes in process flow. Students should not only understand the principles, technical characteristics, application status and development trends of chemical problems in the production process of coal-fired power plants, but also master the basic methods, process flow, principle characteristics and equipment composition of different types of power plant water treatment. With the promotion and application of high-parameter and large-capacity units, some new technology combinations have emerged, along with new chemical and environmental issues. Therefore, the course urgently needs to carry out teaching reforms that keep pace with the times.

The author has compiled a book and used it as a teaching material - "Chemical Technology of Power Plants" [1], the content layout highlights the characteristics of the power discipline system, so that the teaching content of power plant chemistry is closely integrated with the development trend of China's power industry. The reform and experiment of the teaching method of the course has also been carried out [2], but there is still a certain gap between professional engineering certification and double First-rate construction, and further reform and exploration are needed.

Improving the Teaching Effect through the Reform of Classroom Teaching

Strengthen Classroom Exercises around Key Content and Increase Simulation Cases

Chapter 3, 4 and 5 are an overview of water chemistry and are the focus and difficulty of the course "Power Plant Chemistry". Students need to clarify the different water treatment processes, equipment components, water requirements and identify the impact of water treatment components on the performance of water equipment, the characteristics of different process water treatment and the differences in process flow [3].

In the past teaching, it was found that the students often misunderstood the ion exchange chemical reaction equations. Therefore, this reform will strengthen the classroom practice for this part of the content, and repeat the drills with different water quality as examples. The correct rate of
this part of the process assessment is obviously improved. It was also found that the students were unclear and often confused with structural characteristics, operation management and effluent quality of different water treatment equipment. Therefore, we used VB and FLASH to develop the secondary reverse osmosis [4] pure water process (Fig. 1), clarifier [5] simulation interface (Fig. 2), ion exchanger simulation interface (Fig. 3), ion exchange Bed structure and water output curve (Fig. 4) [6,7]. The simulation software includes plates for clarifier simulation and ion exchanger simulation. The final simulation software consists of 27 forms, 8 simulation animations and more than 21 water treatment reactor related images.

Using the intuition of simulation teaching [8], students can deepen their understanding of important knowledge points, increase learning interest, improve learning effects, and overcome the defect of not understanding the relationship between internal structure and equipment flow of power plant [9].

Reform the Layout of School Assignment

Nowadays, the phenomenon of fragmentation of knowledge of college students is very common, and the study of professional courses needs to be systematic and organized. How to sort out students' knowledge, branch the limited information to form linear and block knowledge map and transform their knowledge of points, lines and nets into the ability to become an urgent problem. The application of Mind Mapping solves this problem. The treelike visualization Scheme of "Mind Mapping" is useful, for training learners' divergent thinking ability. To this end, we require students to draw Mind Mapping during the course learning process. As the chapters are carried out, the Mind
Mapping are continuously enriched, forming a network of cross-knowledge systems, rationalizing the knowledge systems and interrelationships of key content, transforming the knowledge of teachers into the knowledge of students and improving their analytical and comprehension skills. The results show that students can summarize and review the knowledge of learning according to their own habits, write their experiences, form good recording habits, and improve their ability to adapt and logically reason.

**Improving the Teaching Effect through the Reform of Examination Method**

**Increase the Intensity of Process Assessment**

The assessment is carried out by combining the usual performance (process assessment + experiment) and the final exam. The scores are based on the hundred-mark system, with 30 points in the usual performance and 70 points in the final exams. At the half of the lecture, the assessment is conducted to examine the students' mastery of the content they have learned and find problems to take timely measures. This course adopts the form of classroom test, It uses 1h period to test the content of the first three chapters, including question and answer, judgment, comparative analysis, etc., in order to examine the students' mastery of the content of the lectures, and the scores account for 20%.

**Emphasis on the Proportion of Experiments**

Experimental teaching (6h periods): Determination of ion exchange capacity (2h periods), ion exchange softening, desalination experiment (4h periods), the experimental results accounted for 10%.

Grasping the practical teaching link and realizing the diversification of teaching makes the traditional teaching mode of simply imparting knowledge into a focus on the cultivation of students' ability, especially the cultivation of innovative ability [10]. The reform of the practical teaching process of this course is reflected in the change of concept and method from cognitive and inheritance to scientific research, from verification to comprehensive and design, from infusion to heuristic, from traditional content to new knowledge and new skill change. The experiments in this course include comprehensive experiments and general experiments. They break the defects of a single experiment which only verify a certain principle or learn a certain operation technique. The basic theories and basic operational skills of different chapters are organically integrated, which greatly promotes the improvement of students' comprehensive quality.

**Enrich the Types of Final Examination Questions**

The type of questions covers judgment, brief answer, essay questions, explanation and drawing. The content and requirements of the questions are generally consistent with the requirements of the teaching syllabus of Power Plant Chemistry (A). It mainly investigates the students'basic knowledge of coal quality analysis, oil for electric power and water treatment in power plant chemistry, as well as the characteristics and uses of water treatment process, and compares and analyses the similarities and differences of different treatment processes, and highlights the principle of using knowledge and improving ability. The examination papers have clear objectives and can be integrated into the research-based teaching concept. It can not only reflect the students' mastery of basic knowledge of coal chemistry, oil chemistry, water chemistry, corrosion and protection, but also inspect the students' ability to solve and design practical problems of power plants by using water treatment basic understanding.

Among the five assessment contents of the final exam, the indicators completed according to the “Graduation Requirements Achieving Scale” are as follows:

The correct rate of judgment questions and brief answer questions reached 80.00% and 82.75%, respectively, both of which reached 80%. Students are very good at mastering environmental engineering expertise. After synthesizing its peacetime performance, the score ratio is 0.80, which exceeds 0.70, and the expected result is achieved.
The correct rates of essay questions, explanation questions and drawing questions were 70.71%, 75.50% and 81.67%, respectively, both of which exceeded 70%. Students applied well in the application of environmental engineering knowledge to analyze complex engineering problems and achieved good results. After synthesizing its peacetime results, the score ratio is 0.76, which exceeds 0.70, achieving the expected result.

The evaluation results show that the degree of achievement of the course is more than 0.70, which can meet the requirements of the corresponding indicators of graduation requirements.

Conclusions
In a word, after carrying out the teaching reform, the students' overall examination results have met the curriculum requirements, and the passing rate of the students taking part in the examination is more than 90%; the proportion of excellent and good students reaches about 50%, the proportion of medium students reaches about 30%, and the failure rate is less than 4%. This shows that more than 70% of the students have comprehensive analysis ability and can use their professional knowledge flexibly.

In the simulation system, students can understand the basic process of water treatment along the direction of water flow, combine it with the operation of each unit in reality, and strengthen the understanding of the integrity of water treatment process. Students can also deepen their understanding of the practical application of the principles they have learned by familiarizing themselves with the dynamic process of each process.

Students' ability to transfer and apply chemical knowledge, innovative thinking and solve practical problems of water treatment in power plants has been trained. They have also won a third prize in the national water treatment energy saving and emission reduction contest and applied for three patents of related utility models. The number of national and school-level innovative experimental projects in our school has been increasing continuously.

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References

