

Research on the Curriculum Reform of Instrument Analysis under the Background of "New Engineering" Talent Training

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Abstract: Under the background of new engineering, with the increasing attention paid to soil safety and food safety, the course of Instrument Analysis, which has an important supporting role for environmental engineering, and has put forward new requirements. This paper analyzes the background of the curriculum reform, discusses the reform of teaching content, teaching methods, teaching forms and assessment methods, and puts forward the main solutions. It concludes that the reform of teaching and practice content is suitable for the environmental engineering specialty "Instrument Analysis", so as to improve the comprehensive professional quality of students.

1. Introduction

The competition in the new era involves many aspects of society, especially the core industries required by the national strategic development. "New Engineering" came into being in this context. "New Engineering" is proposed and developed in response to a new round of scientific and technological revolution and industrial transformation, and in the context of a series of national strategic development, such as supporting innovative service-driven development, "Made in China 2025", and is a sinicization of the reform and development of international engineering education. The major of environmental engineering is an important part of the construction of the "new engineering" project, and it is to cultivate applied professional and technical talents with environmental science and engineering disciplines. Instrument Analysis is one of the main courses in the curriculum system of environmental engineering specialty. It should closely focus on the training objectives of application-oriented talents under the background of "new engineering", enhance students' professional cognition and professional confidence, and serve the new system of environmental engineering specialty courses and teaching contents, in order to enhance students' ability to master the professional knowledge system and solve practical problems, and cultivate application-oriented talents required by society [1,2].

With the development of society, people pay more and more attention to the environmental quality and safety closely related to human health, and the environmental quality data can be obtained

through the measurement of analytical instruments. For example, to determine whether cadmium in soil exceeds the standard, inductively coupled plasma emission spectrometer (ICP-OES) can be used to determine. Therefore, it is very necessary to set up the course Instrument Analysis, which also makes it an important course for environmental majors. According to the curriculum system, the purpose of this course is to let students master the concept, principle and basic operation of commonly used instruments, and understand the scope of use of instruments; According to the object to be measured, we should learn to select the appropriate instrument, improve students' innovation awareness and practical operation ability, and design a reasonable instrument analysis scheme. Therefore, how to teach the content to students within the class hours, stimulate students' independent learning, master the professional knowledge of instrument analysis and the operation skills of analytical instruments, and improve students' innovative problem-solving ability become the key to the teaching reform of this course.

2. The importance of Instrument Analysis

Instrumental Analysis is a course that involves a lot of basic knowledge of physics and chemistry. It is closely related to the courses of environmental engineering and has strong practical operability. It can apply theoretical knowledge to practical operation. For example, the concentration of pollutants in the atmosphere, water and soil can be determined through instrument analysis to take appropriate measures to solve environmental problems. In view of this, Anhui University of Science and Technology has set the course of Instrument Analysis as a professional education course for environmental engineering. Instrument Analysis includes two parts: theoretical teaching and practical teaching: theoretical teaching cultivates students' theoretical literacy of solid basic professional knowledge, and practical teaching cultivates students' ability to operate common instruments, so that students can transform from theory to practice, and improve students' ability to operate and solve practical problems [2,3]. This course can effectively combine theory with practice, cultivate students' practical ability, and deliver a large number of new engineering talents meeting the needs of the society.

3. Main problems in current course teaching

3.1. The curriculum has a large capacity and students' basic knowledge is relatively weak

Instrumental Analysis is a course with strong physical and chemical foundation and a large amount of content, which needs solid basic knowledge as the foundation. The course has 14 chapters in total. In addition to the introduction of Chapter 1, each of the other 13 chapters involves an instrument analysis method, which has many contents. However, the total duration of the course is 32 hours, including 12 hours of experiment and 20 hours of theoretical knowledge. At the same time, this course involves a lot of basic content and is more abstract. Its mechanism involves a lot of physical knowledge and requires rich imagination. In addition, this major has a poor source of students and weak basic knowledge, which limits the understanding and learning of this course.

3.2. The teaching method is relatively simple, and students' learning motivation is poor

The times and technology are progressing, but the development of teaching methods is relatively slow. At present, the teaching method of Instrument Analysis is mainly based on the instillation teaching combined with PPT teaching method [4]. The indoctrination teaching method plays a very important role in the early teaching process, but this cramming teaching method ignores students' diversity, personal characteristics and personality, resulting in students' lack of learning motivation, which limits students' creativity [5].

3.3. The training program is disjointed and the hardware support equipment is lacking

With the rapid development of the new engineering discipline and the updating of the relevant technologies and equipment of the environmental engineering discipline, the traditional Instrument Analysis is difficult to support the development of the discipline, and it is necessary to develop a new outline and knowledge system to adapt to the new professional requirements; At the same time, the course offers 12 hours of practical courses, mainly including spectral analysis, mass spectrometry and other analytical techniques. However, in mass spectrometry analysis, the institute lacks inductively coupled plasma mass spectrometer (ICP-MS). In addition, the number of equipment in practice is small, which cannot meet the training needs of talents.

3.4. Existing teaching materials and practical content cannot meet the needs of new engineering

The existing teaching materials are mainly based on gas phase liquid chromatography, atomic absorption and emission spectrum analysis and infrared ultraviolet spectrum analysis methods. These methods only involve basic analysis principles, analysis methods, equipment structure and simple operation, which is difficult to meet the development needs of environmental engineering under the new engineering discipline; At the same time, the practical content of the design is mainly based on basic experiments. Its content is difficult and easy to operate, which weakens students' learning interest, is not conducive to stimulating students' independent thinking and innovation ability, and is difficult to cultivate students who meet the needs of new engineering.

3.5. The assessment method is single and theoretical

Course assessment is an important part of the curriculum. The scope and method of course assessment can reflect students' grasp of course knowledge intuitively. At present, the examination of Instrument Analysis is mainly based on the examination of theoretical knowledge, while the examination of students' practical operation ability is relatively small, which cannot reflect the requirements of the training objectives of "new engineering" and limits the cultivation of students' comprehensive quality and ability.

4. Main contents of curriculum reform

On the basis of full investigation, in view of the main problems existing in the course of Instrument Analysis and in combination with the needs of the development of new engineering, the teaching reform of this course involves the following aspects, and the specific contents are as follows.

4.1. Teaching content reform

(1) Theoretical course content: optimize the theoretical course content. The textbook Instrument Analysis for environmental engineering majors adopts the textbook of Higher Education Press (the fifth edition, edited by Hu Ping and Wang hydrogen). At present, the Instrument Analysis of the environmental engineering specialty of Anhui University of Science and Technology mainly completes gas chromatography analysis, high performance liquid chromatography analysis, atomic emission spectrometry analysis, atomic absorption spectrometry analysis and ultraviolet absorption spectrometry analysis, and combines the existing class hours with the actual situation of the environmental engineering specialty to combine gas chromatography analysis, high performance liquid chromatography analysis, atomic emission spectrometry analysis Ultraviolet absorption spectrum analysis, mass spectrometry and other analytical techniques (infrared absorption spectrum, atomic absorption) are important theoretical teaching contents.

(2) The content of the experiment course: change the previous experimental setup based on the basic verification experiment, and add the design, comprehensive and innovative experiments.

According to the application characteristics of environmental engineering specialty, teachers' experiments should combine students' independent learning and improve their comprehensive quality and ability to choose topics independently, and implement the experimental teaching mode at four levels, including basic verification, design, innovation and comprehensive. The experiment is from simple to deep, simple to complex, single to comprehensive, to improve students' comprehensive practical operation ability. We should guide students to pursue and explore the frontier and hot spots of scientific research in this major, discuss in combination with this course, and verify through literature review and practical operation. In addition, we can promote teaching through various competitions, select appropriate detection and analysis methods, and design reasonable programs, which can not only stimulate students' interest in learning, but also improve their enthusiasm for learning.

4.2. Reform of teaching methods

4.2.1. Strengthening the training of students' practical ability

Instrument Analysis is a course that combines theory with practice. The cultivation of students' practical ability is one of the important objectives of this course. Therefore, it is very important to improve students' practical ability in the teaching process. The reform of students' practical ability is as follows.

(1) Flip the classroom. On the basis of teaching the course, we need to assign tasks to students and group them, let students participate in the course production and explanation, and improve their thinking and hands-on ability through the process of collecting data, making PPT, course explanation, and after-class analysis.

(2) Participate and experiment in person. It is very important for students to operate by hand during the experiment. There is a problem that the instruments and equipment in this course cannot meet the teaching requirements. Therefore, these actual conditions should be considered in the experiment process and effective arrangements should be made to ensure that students can operate the experiment by hand. For example, the method of division of labor between group leaders and members can be adopted. After the experiment, relevant assignments can be arranged to stimulate students' ability to participate in innovation.

4.2.2. Optimizing teaching methods and improve students' innovative ability

Innovation has always been an inexhaustible driving force for the development of a country and industry. It is particularly important to cultivate students' innovation ability in the teaching process. In order to improve students' innovative ability, some open and interactive teaching can be added to the classroom teaching. For example, when teaching the content of atomic emission spectrum analysis course, students can be required to discuss the application of this analysis method in environmental detection and analysis, design assumptions and verify them in groups, and form a final report. Teachers guide students' hypothesis experiments, analyze the reasons for failure, and summarize successful experience, in order to cultivate students' innovative ability from indoctrination teaching.

4.3. Reform of teaching form

With the progress of science and technology, teaching methods have become diversified, especially after the outbreak of the COVID-19 epidemic in 2020, online teaching has become very popular. At present, many colleges and universities have launched online courses of Instrument Analysis, such as Beijing University of Chemical Technology, Zhengzhou University, etc., which enables teachers to enrich teaching forms by combining online and offline teaching methods. Online experimental teaching is also on the rise, which can be combined with experimental practice courses, and make use of a large amount of network information to make the practice courses lively. At the same time, the

instrument analysis experiment is designed in close combination with the characteristics of the environmental engineering specialty, focusing on the design-based, comprehensive and innovative experiments. In addition, the addition of curriculum ideological and political education in the teaching process is conducive to teachers' personalized teaching for students, so that the curriculum and ideological and political education are highly unified.

4.4. Reform of assessment methods

The previous assessment of Instrument Analysis mainly focused on the assessment of theoretical knowledge, especially the content of the theoretical course. Therefore, the syllabus can be revised to increase the assessment of practical ability in the assessment method, adjust the weight of theory and practice, the assessment time and the assessment method, such as increasing the proportion of students' daily learning performance, and increase the students' comprehensive quality inspection, in order to improve the classroom control and activity, and stimulate students' thinking and comprehensive quality ability.

5. Conclusion

Under the background of new engineering, with the increasing attention paid to soil safety and food safety, environmental protection has ushered in new opportunities and challenges, and new requirements have also been put forward for the basic courses that support the professional knowledge of environmental engineering. In order to solve the problems such as the disconnection between the talent training program and practice, the weak hardware support, and the lack of comprehensive innovation experiments in the course of Instrument Analysis, the teaching reform of the course of Instrument Analysis was carried out from four aspects: teaching content, teaching method, teaching form and examination form. China's environmental engineering education started relatively late. In the era of emerging new technologies, curriculum reform was carried out in combination with professional characteristics to improve students' professional quality and continue to output high-level application-oriented talents meeting the needs of the new engineering background.

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