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Research on the Course of Principles of Concrete Structure Design

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Abstract: Nowadays, education and teaching have become a hot topic, and teaching in colleges and universities is facing a brand-new development direction. Principles of Concrete Structure Design, as one of the main courses, transmits professional knowledge for students, enhances the students' professional ability, and further carries out in-depth research on the course to bring a better teaching effect for students. The article mainly focuses on the research of the principles of concrete structure design course, conducts an analysis of the teaching characteristics of the principles of concrete structure design course, and reasonably sets the teaching content from the optimization of the course teaching objectives; innovative course teaching methods can deepen the effect of knowledge understanding; reform of experimental practice teaching can lay down the effect of the internalization of knowledge, etc. The in-depth description and discussion of the relevant aspects of the research aim to provide guidelines for related research.

Keywords: Concrete structure design principle; Course characteristics; Teaching innovation; Course research

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1. Introduction

As one of the main places for talent training, the Principles of Concrete Structure Design course is a compulsory course, which involves a wide range of knowledge content. It not only has multiple teaching difficulties but also contains a lot of formulaic content. Students face a certain degree of difficulty in learning, and in severe cases, there will also be a certain degree of resistance to the course content. In view of this situation, it is necessary for teachers to combine the content of the Principles of Concrete Structure Design course, introduce novel and interesting teaching content for students, further satisfy the industry's standard of knowledge and skill mastery for talents, implement diversified teaching methods, mobilize students' interest in learning the course content, and appropriately increase the proportion of practical teaching. It aims to provide students with a brand-new learning experience and internalize their knowledge in the understanding, and to provide support for students to better learn the Principles of Concrete Structure Design course.

2. Teaching characteristics of the Principles of Concrete Structure Design course

2.1. Diversity

Principles of Concrete Structure Design course is compulsory content for students, which contains content reflecting the diversity, not only to lead students to master a wealth of civil engineering knowledge but also for students to learn the actual engineering calculation methods and material construction, etc., which will be used in the future workplace [1]. There is a lot of content in the course, and in order to achieve excellent results, students need to spend time and energy to fully consolidate theoretical knowledge as well as take the initiative to accumulate practical experience. Precisely because students have to master a wide range of knowledge, the teacher should comprehensively explain the content of the course during teaching, and when necessary, provide students with rich extracurricular resources to truly build an efficient classroom of Principles of Concrete Structural Design.

2.2. Experimental

In the Principles of Concrete Structure Design course, students are required to master the knowledge of engineering structure force performance, be able to flexibly use the basic theory of design, and accurately master the calculation method [2]. However, in these knowledge explanations, it is necessary to clarify the matching research object, such as reinforcing steel, concrete, etc. For example, in the study of concrete structure research process, since concrete has a certain degree of elasticity and plasticity, the teacher cannot carry out the teaching only through theoretical knowledge but rather organize experiments for students to learn through practice. Based on a variety of experiments, assumptions about the focus of the study content are made, the different objects of the study are selected, and the calculation methods are adopted. There are differences in the calculation methods, and the final design structure obtained is also diverse. Through the experimental form, the calculation formula is presented more specifically to deepen students' understanding and mastery of the calculation formula.

2.3. Practicality

Principles of Concrete Structure Design course has certain differences with other courses, this course has a certain degree of practicality and needs to deepen the mastery of theoretical knowledge on the basis of practice. For students to fully grasp the knowledge of the course, we must participate in the process of design to obtain more practical experience, truly grasp the materials that may be used in construction projects, the structural characteristics of various materials, as well as a variety of factors that affect the structure. Teachers integrate knowledge and practice to strengthen the teaching efforts of the curriculum. While integrating theoretical knowledge in the course, they also carry out experimental learning for the students. teachers are required to organize construction projects for the students and clarify the key points in building structural design, laying the foundation for smooth entry into the workplace in the future [3].

3. Research path of the Principles of Concrete Structure Design course

3.1. Optimizing the teaching objectives of the course and formulating the teaching content reasonably

In the Principles of Concrete Structure Design course teaching practice, the ultimate goal of teaching is to supply applied talents to the community. Teachers set the course objectives for students according to the actual development needs of society. Teachers, schools, society and other subjects jointly formulate the teaching objectives of the course, place students ability development in an important position, and present new goals with teaching characteristics. According to survey and analysis, many employers in the industry pay great attention to the comprehensive quality of students, as well as their own knowledge structure and skill application ability,

and require students to be able to solve the structural problems encountered at work using the skills. Therefore, when teachers formulate teaching objectives for students, they should implement the idea of "applying what they have learned," refine the formula to the process, appropriately remove some of the non-key content. Instead, teachers should focus on the actual application of knowledge and add more targeted teaching content, so that students can truly understand the meaning of the engineering structure and comprehensively master the basic design methods of engineering structure. The basic design methods of engineering structure and the appropriate introduction of BIM (Building Information Modeling) educational ideas lead students to constantly innovate their thinking and keep abreast of the times to understand the changes in concrete structures [4]. At the same time, teachers should follow the objectives of the course and introduce more teaching content for students, so that they can master the design of bending, shear, tensile, and torsion elements of concrete members. In addition to explaining the formulae, charts, bearing capacity design, etc., contained in the original course, teachers should also provide richer extracurricular resources for some of the fuzzy knowledge in the design process, further innovate the teaching content, and let the students digest the knowledge in the summarization. On the one hand, it realizes the important position occupied by the Principles of Concrete Structure Design course, on the other hand, it also highlights the value of the training of applied talents. For example, in the study of rectangular cross-section implementation of positive section design content, students are required to arrange three key points of content, the first requires students to calculate the effective height h0; the second requires students to calculate the actual height of the compressed area x; thirdly, it requires students to complete the design of the area of reinforcement As; through the above steps, it ultimately arrives at h0 → x → As.

3.2. Deepening the effect of knowledge understanding through innovative teaching methods

To achieve better teaching results in the course of Principles of Concrete Structure Design, it is necessary for teachers to understand students comprehensively, choose novel teaching methods, mobilize students to participate in teaching activities wholeheartedly, arrange each lesson carefully for students, and lead students to think in teaching activities and understand knowledge in the interaction between teachers and students.

First is group cooperative inquiry learning. Principles of Concrete Structure Design course contains a lot of formula derivation, if the teacher directly tells the students the formula and the students memorize it without understanding the formula, it is difficult to motivate the students to achieve excellent results. Teachers can choose a reasoning formula, write the formula on the blackboard, and ask "What is the real process of the formula?" to stimulate students to think. Students are then divided into different study groups and encouraged to collect materials in the group. Each student is responsible for a part of the activity, and ultimately grasps the origin of the formula through mutual communication, with the teacher playing a guiding role to provide students with the learning direction. After the students have a certain understanding of the formula, the teacher assigns tasks for students to complete. The members of the group discuss and share with each other, not only to consolidate their own knowledge mastery, but also to learn from other students in the use of the formula [5].

Secondly, the implementation of flipped classroom teaching is carried out. The selection of resources should be improved before class. In order to highlight the advantages of the flipped classroom in course teaching, teachers need to make teaching arrangements in advance, collect and integrate online learning materials for students, and select the video content that is connected with the Principles of Concrete Structural Design course, so that students can have a clearer knowledge before class. For example, the teacher can choose to play the three-dimensional view video of beam column, the students can have a comprehensive understanding of the location of reinforcing steel, and also have a certain knowledge of the form of the structure, which change the students' rote learning mode. Through this, students can familiarize themselves with the content before the class, leading students to enter the follow-up study in a short time, the ultimate goal is to stimulate students'

desire to learn. In addition, there is a lot of knowledge in the course content for students to actively participate in the investigation of learning. In the investigation process, if teachers only present the course content on the board, students will inevitably be confused about the knowledge; if the teacher uses the flipped classroom to introduce sound, images, and other technologies to present students with a more realistic experimental situation, such as micro-course video on the study of destruction characteristics of the positive cross-section of bending members. The students can be led to comprehensively analyze the differences between the three videos through micro-course videos, and ultimately obtain twice the learning effect with half the effort [6]. Lastly, after the flipped classroom teaching, a key review link should be designed. There may be some students who do not have a full understanding of the knowledge, teachers can use the micro-course form to deepen the students' knowledge consolidation effect. By making a short micro-video of the difficult points in the course content, students can review it at any time and deepen their mastery of the knowledge through the video. The teacher can also be the first to get the students' test results to facilitate the prompt adjustment of the teaching measures.

3.3. Reform of experimental practice teaching and laying the effect of knowledge internalization

In order to better meet the industry's demand for talent, college teaching practice highlights the cultivation of students' practical skills, carries out targeted practical training process, deepens students' understanding of knowledge, and further enhances the ability to apply knowledge in practice. On the one hand, it is necessary to optimize the experimental system of the curriculum, appropriately increase the experimental teaching courses, focus on exploring reinforced concrete structure, introduce computerized structural simulation test links, and make full use of computers to carry out simulation of structural experiments. The implementation of the "four new" concept in the experimental process not only focuses on the exploration of new materials and processes, but also explores new methods and technologies in teaching, constantly optimizes the experimental teaching methods, changes the status quo of the teacher occupying the main body of the experiments in the past, and enhances the teaching interaction between the teacher and the students, so that the students can really master the knowledge in the experiments. Through the experimental courses, students can fully grasp the methods used in the experiments of engineering structures, understand the implementation of the experimental techniques, and also enhance their innovation and research ability. At the same time, colleges and universities should also establish contact with enterprises to carry out school-enterprise cooperation in experimental teaching, improve the integration effect between experiments and engineering, provide more experimental materials for students, and truly implement the experimental nature of course teaching [7]. On the other hand, it is necessary to create an autonomous experimental teaching system. For autonomous practical teaching, the teacher provides students with experimental objectives, selects suitable experimental sites for students, equips appropriate experimental equipment and materials, encourages students to carry out research in independent study to better complete the construction design, clarifies material mixing ratio, complete the determination of the degree of material, etc., and then integrates the experimental data and ultimately summarizes them into their own experimental report. For example, to carry out the "simply supported reinforced concrete beam bending performance experiment" process, the teacher requires students to be able to independently complete the corresponding study, such as rebar material, concrete pouring, experimental loading, etc. When necessary, teachers provide guidance to the students with questions. In this independent practical learning, it is not only conducive to the construction of a more complete knowledge system but also conducive to a more in-depth understanding of the knowledge, further forming an engineering way of thinking, and truly understanding the overall concept of the course. At the same time, it also provides a platform for students to innovate, inspires students to participate in research, enhances scientific research ability in hands-on practice,

and fully realizes the importance of practical teaching in the Principles of Concrete Structure Design course.

4. Conclusion

In summary, due to the rich content in the Principles of Concrete Structure Design course, it is easy for teachers to have difficulties in teaching and students to have poor learning effect in the teaching practice of the course, resulting in the lack of interaction between teachers and students and difficulty for the students to build a perfect knowledge system. In view of this situation, teachers, as a key figure in the transfer of knowledge, should innovate their teaching ideas, be aware of the importance of teaching details, incorporate more knowledge content based on the actual learning needs of students, and introduce a variety of teaching methods to create a positive classroom learning environment to mobilize students' desire to learn. These not only can deepen the students' understanding of the knowledge but also optimize practical teaching to improve students' application of knowledge and truly realize students' comprehensive development.

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