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A Preliminary Study on the Case Teaching of Electromechanical Transmission and Control

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Abstract: "Mechanical and electrical transmission and control" is a professional required course of mechanical and electronic engineering, also it is the body of the electrical knowledge structure needed by the mechatronics talents. With the development of the "Made in China 2025 Plan", the social demand for mechatronics talents is increasing. This paper analyzes some problems existing in the course teaching of Electromechanical Transmission and Control, Combined with many years of teaching work experience, This paper preliminarily discusses the exploration and reform of the case teaching mode in the electromechanical transmission and Control course, so as to cultivate the application-oriented skilled talents more effectively.

1. Introduction

"Mechanical and electrical transmission and control" is a professional required course of mechanical and electronic engineering, also it is the body of the electrical knowledge structure needed by the mechatronics talents. With the rapid development of electrical control technology, especially the development and application of programmable program controller, AC speed regulation and other technologies are becoming more and more perfect, Especially in the development of science and technology and the needs of mechatronics application, it is very necessary to master the basic knowledge of electrical technology

Through this course and its practical teaching, the students can acquire the basic theory, basic knowledge and basic skills of the electromechanical transmission control, and understand the development trend and the latest technology of the electromechanical transmission and control system, so as to broaden the students' vision and adapt it to the needs of the continuous development of modern production. Application-oriented universities are the main bases for cultivating and conveying professional talents for the society. Therefore, exploring the application of case teaching methods in the teaching course of "Mechanical and Electrical Transmission and Control" is of great practical significance for the promoting the process of teaching reform and cultivating excellent applied technology in the new era.

2. The Current Deficiencies in the Teaching of Mechanical and Electrical Transmission and Control

2.1. Teaching Environment Changes, the Traditional Teaching Mode is Challenged, and Teachers' Teaching Level and Way Need to Keep Pace with The Times

In recent years, with the impact of COVID-19, “cloud teaching” and online teaching are now also common. With the deepening of educational reform, many factors make teachers need to actively update their educational concepts, improve their teaching methods, innovate their teaching modes, and achieve better teaching results. But influenced by the traditional education concept, in the mechanical and electrical transmission and control course teaching largely use traditional teaching mode, Take the content of the teaching material as the center, the student main body position is not enough attention, students are always in a state of passive learning, lack of high learning enthusiasm, not up to high the interest in learning, thus affecting the learning efficiency, so it is difficult to achieve satisfactory teaching effect. In addition, some teachers do not have a good application of modern teaching methods and carefully design teaching links and integrate teaching content, which is also an important aspect affecting the quality of teaching [1].

2.2. Experimental Equipment and Experimental Training Content Need to be Updated Urgently

Many schools are affected by the limited funds, and the modern experiment and practical training equipment required by the course of “Electromechanical Transmission and Control” and the related comprehensive practical training is a state lagging behind the new technology. Because of the backward school training equipment and insufficient facilities, most of the teachers have only completed the basic content of experiments or practical training in the actual teaching. The cultivation of engineering practice ability is in a state of “food and clothing”, but the application of new technologies and new functions still depends on the teacher’s teaching and is the state of “talking on paper”. These hinder the improvement of students' professional skills, and is not conducive to the comprehensive development of students. In the long term, it will inevitably affect the quality of the training of highly skilled and applied talents.

2.3. Course Hours are Limited, Separating Theoretical Teaching from Practical Teaching

The compression of credit hours of talent training program leads to the continuous compression of class hours in the curriculum. In the limited class hours, if the focus on practice, “the reason of why” is not understood, knowledge cannot be inferred from one example; if the focus on the theory, the student's practical ability is poor. The disconnection between theoretical teaching and practical teaching is a common problem in the course teaching of Mechanical and Electrical Transmission and Control. If students cannot deepen their understanding of theoretical knowledge through practical teaching in time, or they cannot timely improve their practical ability on the basis of theoretical knowledge learning, and complete the transfer of knowledge, all of these will seriously hinder the cultivation of high-tech applied talents.

3. Case Teaching Exploring the Teaching Mode in Mechanical and Electrical Transmission and Control

3.1. Update the Educational Concept and Be a New Teacher in the New Era

Teachers should change from the thought at first, Study hard the construction ideas of new engineering, first-class talents and first-class courses, keep pace with The Times to learn new technologies and the new technology and science in nature, as well as advancing with The Times of new education and teaching methods, etc. New talents first need new teachers. At the same time, the new technologies are based on the basic knowledge and the traditional knowledge. Basic professional knowledge should not be explained, but new technologies should be integrated, and they should meet the national talent quality training standards. At a given class hours, we should actively open up new classrooms, combine online and offline standards, and set scientific curriculum construction standards.

3.2. The “Modularity” Setting of the Curriculum should be Scientific and Use the Case to Prove its Corresponding Modular Knowledge

Curriculum is the carrier of concentrated reflecting the educational concept, teaching idea, teaching method and teaching mode. The teaching of electromechanical transmission and control curriculum should have the curriculum setting consistent with the major, and the specific realization is: teaching materials, teaching plan, teaching content.

According to the content of the course, the course is modularized, the course is divided into two major modules. One major module is the relay-contact or control system module. This includes a number of submodules, Such as low-voltage electrical appliances, control circuit basic links and typical system analysis and basic design methods; the second major module is the principle and application of PLC. When explaining the big module, we can cite “tree trunk type” outline case, so students can understand what engineering problems can be solved with such knowledge points; when it comes to submodules, you can cite “branch type”, students can know how to use this knowledge point.

Such as milling machine bench automatic cycle reciprocating PLC control, different color ball sorter PLC control, intersection traffic light PLC control, and each case proves a teaching module. In qualified schools, the theoretical and practical teaching of the same module curriculum can be carried out simultaneously. Implement a modular curriculum, and use specific cases to prove their knowledge points, and promote students to better combine professional knowledge with practice, Improve the professional comprehensive application ability, professional judgment ability and the use of professional theory ability to analyze and solve problems [2].

3.3. Reform of Education and Teaching Methods

The course “Electromechanical Transmission and Control” contains many theoretical knowledge points, The number of practice program credit hours is limited。Some students have a high fear of difficulties, poor thinking ability, understanding ability is not enough, so the overall performance will be uneven, two-stage differentiation is obvious. Combined with the original traditional way of simple classroom teaching, keep pace with The Times and integrate a variety of teaching methods to enhance students' interest in learning [3]。

1) Use of online resources, video viewing method, such as college MOOCS/ Superstar class. Students can understand the powerful use, appearance, work mode about machine tools and the application of electromechanical transmission technology in machine tool control, students’

curiosity about learning the course is stimulated through short videos.

2) Theory teaching method. Students master the knowledge of various low-voltage electrical components, motor dragging working principle, the basic links of electrical control, working principle of PLC and so on.

3) Flipped classroom or discussion teaching, such as gaming methods. When explaining the case application of a certain module of knowledge, let the students understand the theoretical knowledge points through games. Generally, the students are more active during the game, and can remember the important content in a short period of time, thus the interest in the learning of this course is stimulated.

4) Practical operation method to improve students' engineering application ability. In the practice teaching, the teacher groups the students reasonably, so that every student should have the task of using their hands and brain, and the teacher should do a good job of recording the students' practice process. "No rules, no circumference". The combination of theory and practice is prominent, and the difficulties are explained thoroughly.

5) Virtual simulation method, teachers should innovate classroom teaching methods constantly, such as the introduction of simulation software teaching tools. Teachers should use the simulation software reasonably. Through the simulation of the field operation, it can achieve twice the result with half the effort. At the same time, it can make the abstract course teaching content more vivid and interesting, and the cost of teaching is reduced, and the quality of teaching is improved.

3.4. Build an Independent Learning Platform with the OBE Concept, and Follow the Students' Personality Development

When implementing case classes, teachers should take the OBE concept, pay attention to the main position of students, and give students enough time and space to explore and learn, so that students can form independent learning habits.

For example, when the teacher assigns large-scale homework, he divides the students into several study groups. Each group discussed the rationality of the project implementation plan, the component selection principles, virtual simulation method, fault problem handling and other contents. In this process, teachers should not interfere too much, and don't ignore the students' independent study. Instead, we should set the process control and give appropriate guidance to ensure the effectiveness of students' learning. Teachers should encourage students to actively communicate, discuss the control scheme, learn from each other, and finally solve problems. Finally, it improves the professional level of students and promotes the development of students' personality, and forms the three-meeting talents who can "think, learn and communicate" [4].

4. Integration of Teaching and Evaluation

Influenced by the influence of traditional teaching mode, teachers generally determine the evaluation of students' learning effect according to the test scores. But the test results do not represent the students' practical operation ability, "An armchair strategist". It is difficult to cultivate the skilled talents that meet the needs of the enterprises for the traditional teaching system. Mechanical and electrical transmission is a highly technical professional course, and this traditional evaluation method is no longer suitable for contemporary students. Integrated teaching evaluation completely breaks the traditional curriculum teaching, and the teaching methods are becoming more and more rich, such as using task-driven teaching. Students study in the "work", and students' learning is the work. The student general evaluation result includes both the test paper results and the process assessment results. Through the process assessment, teachers can understand the students' learning attitude, learning effect and their ability to use knowledge from other examples.

The form of process assessment includes a variety of situations, such as class attendance, homework, classroom questions, experiments, design and query machine tool fault. Integrated teaching has broken the state of fixed test [5].

5. Introduce Ideological and Political Cases to Cultivate Students' Spirit of Exploration

Whether in theoretical teaching or practical teaching, after learning new knowledge points, we must have the ability to think independently, so we can master the knowledge content of each module. In the process of guiding students to learn to think independently, teachers can introduce cases which can be corresponding to the celebrity funny stories, and engineering cases with the knowledge points, the teacher carried out ideological and political education, such as love to study, love of science, patriotism and so on, At the same time, and stimulated the students' learning spirit.

6. Conclusions

In short, we should continue to improve the teaching concept, continue to learn, Double-qualified teachers will be created, teachers have "skill in wielding the 18 kinds of weapons". And it is necessary to set up the teaching content scientifically, integrate and enrich the cases, Theory and practical teaching are perfectly combined, Let the students really become the master of learning. So that we can train more high-quality and high-level applied technical talents for the Country, and add bricks and tiles to the national construction.

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