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Teaching Research of Mechanical Design Course in Vocational Colleges

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Abstract: The Mechanical Design course plays an important role in the education system of mechanical majors. It provides students with the necessary theoretical knowledge and practical skills of mechanical majors, and has an important role in promoting students' professionalism and employability. The purpose of this study is to explore and provide useful ideas and suggestions to improve teaching quality of Mechanical Design courses in vocational colleges and universities, with the goal of promoting the development of vocational education. The research team firstly elaborates the research results of the previous scholars, and then puts forward six targeted suggestions to improve the teaching quality of the Mechanical Design course in view of the existing problems in the teaching of the Mechanical Design course.

Keywords: Teaching; Mechanical Design course; Vocational college; Vocational education

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1. Introduction

Vocational education is crucial for promoting economic growth and productivity, and addressing skills shortages. It provides individuals with practical, hands-on training and equips them with the necessary skills and knowledge to succeed in their chosen careers. Vocational education is also an essential component of workforce development strategies and a key driver of economic and social progress [1]. The quality of teaching in vocational education is directly determined by the teaching methods, which have been extensively examined by vocational education professionals [2].

Mechanical design is a core course in mechanical engineering, which plays an important role in cultivating students' practical operation ability and engineering literacy. However, there are some problems in the traditional teaching mode of Mechanical Design course, such as the content of teaching materials being too theoretical, the lack of guidance for practical situations, which means the needs of engineering practice are not met. Traditional classroom teaching generally adopts a "fill in the blanks" mode, which makes students lose interest in the course. Therefore, it is imperative to reform the teaching of Mechanical Design courses.

In this paper, we put forward some innovative teaching methods on the basis of exploring the teaching reform of Mechanical Design course. Firstly, the research results of the previous scholars and the existing problems in teaching are analyzed. Secondly, six targeted suggestions are put forward to improve the teaching quality of Mechanical Design courses. The teaching reform of Mechanical Design course is a complex and long-term process, which requires the joint efforts of teachers and students in order to

continuously explore suitable teaching methods and modes.

2. Research status

Much research has been carried out on teaching of Mechanical Design course. Wei [3] studied the analysis of teaching design and implementation of online Mechanical Design course under the outcome-based education perspective. He designed the teaching from three aspects: training objectives, teaching methods, and evaluation system; and he constructed the teaching implementation plan of the online Mechanical Design course. Chen [4] studied the project-based teaching of Mechanical Design Foundation course. He analyzed the status quo of the course Mechanical Design Fundamentals and adopted project-based teaching . Du [5] carried out ideological and political teaching of Solid Works Mechanical Design course based on the Conceive Design Implement Operate (CDIO) concept. He found that the educational concept was effective, and the project-based teaching method not only stimulated students' interest in learning, but also improved students' abilities in terms of 3D design and engineering skills. Zhou [6] discussed the teaching design of basic Mechanical Design course integrated with "curriculum ideology and politics." He proposed a strategy to stimulate students' enthusiasm and sense of responsibility for learning and strengthen students' national sentiment through the comparison of history and the current situation in China and abroad. Zhang [7] studied the reform of Mechanical Design curriculum design of first-class majors. He explored the reform in three aspects: teaching organization, teaching methods, and grading. Lin [8] studied the reform and practice of ideological and political teaching of Mechanical Design course. He believes that we should pay attention to the integration of critical thinking and politics before, during and after the class, so as to teach the professional knowledge of the course while guiding students' ideology and morality. Zhang [9] studied the new teaching mode of basic Mechanical Design courses based on the concept of "curriculum ideology and politics." He believes that integrating the ideological and political ideas into the teaching system of Mechanical Design course will resolve some of the problems in the teaching of Mechanical Design course.

3. Problems Faced

Mechanical Design is a professional technical basic course that pays attention to both theory and practice. If students cannot master this course, they will not be competent for their future jobs. Therefore, on the basis of previous research, this paper puts forward six problems in the teaching of Mechanical Design course.

3.1. Outdated teaching materials

The course materials Mechanical Design of some vocational institutions are relatively outdated, in which the content is not in line with the current industrial applications and market demand. As the technology in the field of Mechanical Design is developing rapidly, if teaching materials does not keep up needs of the industry, the knowledge students learn will be outdated.

3.2. Insufficient practical teaching

Mechanical Design is a course that requires practical operation and experimental verification, but some vocational colleges lack advanced laboratory equipment and a suitable environment for practical lessons. As a result, students are unable to master the practical application of Mechanical Design.

3.3. Teachers' level is not high

The teachers of Mechanical Design courses in some vocational colleges are subpar, and they lack industry experience and advanced technical knowledge. Therefore, they cannot provide students with comprehensive and practical Mechanical Design knowledge and skills.

3.4. Lack of interdisciplinary integration

Mechanical Design involves a combination of physics, materials science, computer science, and other multidisciplinary knowledge for comprehensive application. However, some vocational colleges lack interdisciplinary curriculum and integrated teaching content, thus the students cannot be provided with comprehensive Mechanical Design knowledge and application capabilities.

3.5. Lack of innovation education

Mechanical Design requires a certain degree of innovative thinking and ability, but some vocational colleges and universities lack innovative education and are unable to cultivate students' innovation skills, which may lead to students not having the ability to solve practical problems.

3.6. Quality of students varies

The quality of students in Mechanical Design courses in vocational colleges varies. Some students are not motivated to learn, and they only listen to lectures passively. These students also often lack interest in the field of Mechanical Design, and find it difficult to devote themselves to learning. Some students have only been spoon-fed by their teachers, so their learning effect is poor.

4. Specific suggestions

The innovation of teaching method of Mechanical Design course in vocational colleges is important to improve students' practical application ability and innovation skills, and to cultivate professional skill talents who are highly adaptable. Therefore, this paper puts forward six suggestions for the reform of the Mechanical Design course.

4.1. Combination of practice and theory

Mechanical Design is a very practical course, students need to master skills through practical operation while learning theoretical knowledge. Teachers can organize experiments, internships, competitions, and other forms of practical activities, so that students can apply theoretical knowledge to practical operations and cultivate their practical skills. Teachers can also allow students to participate in Mechanical Design projects, so as to exercise their hands-on and teamwork skills.

4.2. Project-based teaching

Mechanical Design is a very practical subject, and project-based teaching can make students learn and master the relevant knowledge and skills of Mechanical Design. Project-based teaching simulates real Mechanical Design scenarios, so students can better understand the workflow and related technology of Mechanical Design. In addition, project-based teaching can also stimulate students' innovative thinking and creativity, so that they can better explore the application of Mechanical Design. Teachers can select suitable projects for teaching according to students' interests, so that students can practice in real projects to better master the knowledge in the Mechanical Design course.

4.3. Diversification of course contents

There are many knowledge points in the Mechanical Design course, so teachers can classify and integrate the course contents according to students' needs and interests, and provide diversified teaching resources to enhance their students' interest in learning. For example, teachers can use teaching videos, online courses and other teaching methods to meet their students' needs according to their learning progress. Teachers can introduce digital teaching tools, such as virtual simulation and digital design, to motivate students to learn and produce good learning results. Through digital design software, students can understand the principles

and applications of Mechanical Design in a more intuitive way.

4.4. Cooperative group learning

Group assignments and presentations are effective teaching methods to encourage students to learn actively. On one hand, these methods increase the interaction and cooperation among students and makes them participate more actively in the classroom. On the other hand, students will be encouraged to ask questions think critically. In this way, they will be able to understand the principles and applications of Mechanical Design more deeply. Therefore, teachers can assign group projects to their students, so as to cultivate students' teamwork spirit and innovation ability.

4.5. Build a channel learning platform

With the continuous development of science and technology, the teaching software of Mechanical Design is also constantly developing and updating. Teachers should keep up with the latest teaching software and equipment, and integrate them into teaching. Therefore, it is necessary to build an online teaching platform where teachers can provide students with online teaching resources and real-time interactive functions, which can help students better learn and understand Mechanical Design knowledge. At the same time, teachers should regularly open online Q&A to encourage students to ask questions. In addition, an online teaching platform also allows the use of modern teaching methods such as virtual simulation experiments, so that students can understand the principles of large machinery and equipment operation more intuitively, and apply them to practical problems more flexibly, so that students can master the most knowledge with the least amount of time.

4.6. Guide students to participate in skills competition

By participating in Mechanical Design skills competition, students can experience the charm of Mechanical Design, and their enthusiasm and interest in learning will be stimulated, making them more motivated to learn. Mechanical Design skills competitions helps in improving practical skills and requires participants to complete Mechanical Design and manufacturing tasks within a specified time frame. The contestants will need to utilize their practical skills, keep exploring and experimenting, and improve their overall quality in practical operations. Teachers can also integrate the content of Mechanical Design competitions into classroom teaching. This is because on one hand, it can stimulate the students' interest and curiosity in learning; on the other hand, it can make students understand the importance of Mechanical Design course and enhance their learning motivation.

5. Results

In recent years, with the continuous progress of science and technology and the rapid development of industry, the knowledge in the field of Mechanical Design has been enriched and deepened. In view of this, the requirements for cultivating qualified Mechanical Design talents have also been increasing. The traditional teaching methods of Mechanical Design course can no longer meet the current needs of students, so it is imperative to reform the teaching of Mechanical Design course. In this paper, on the basis of exploring the reform of Mechanical Design course teaching, some innovative teaching methods and teaching means are proposed. This article can act as a reference for the teaching innovation of frontline teachers.

6. Conclusion

It is of great significance to reform the teaching of Mechanical Design course to cultivate Mechanical Design talents. Teachers must be innovative in their teaching methods. Besides, teachers should consider

the actual situation of students and characteristics of the course to improve the teaching of Mechanical Design. Only by adopting new teaching methods can students' learning interest and innovation skills be stimulated, and more excellent Mechanical Design talents can be cultivated.

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Author contributions

M.L. conceived the idea of the study and wrote the first draft. X.Z. revised the format of the article.

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