Exploration on Practical Teaching Reform of Steel Structure Course based on Virtual Simulation Technology

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Abstract: The course of steel structure mostly focuses on theoretical teaching, experimental teaching is relatively small, students' practical ability needs to be strengthened, and open experimental teaching platform is needed for practical teaching. Through the virtual experimental teaching platform for experimental teaching, it can ensure that every student can truly participate, improve the practical ability, break the time and space constraints, introduce an open experimental teaching platform, add a large number of simulation experiments through the experimental platform, thus assisting the teaching of steel structure course, the experimental content can be more. Through the virtual experiment platform, students can design their own experiments and improve their comprehensive ability.

Keywords: Steel structure course; Practical ability; Virtual simulation; Experimental teaching platform

1. Introduction

1.1. Background of steel structure experiment teaching

Steel structure course is one of the core courses of civil engineering specialty. The state and society have put forward higher requirements for the teaching of steel structure course. Students need not only solid professional knowledge, but also strong practical ability and innovative ability. The traditional practice teaching of steel structure course often adopts such methods as visiting factories or construction sites, supporting validation experiments, and a small number of students participating in scientific research experiments. However, most colleges and universities that do not have experimental conditions adopt such measures as visiting engineering projects, watching video materials, designing and making structural models and loading tests to enhance students' understanding of the mechanical properties of basic components and structural systems. However, visiting engineering projects and watching video materials can only provide students with an intuitive understanding of steel structure. However, due to the lack of practical teaching resources and experimental conditions in many schools, traditional practical teaching methods and methods have been difficult to meet the teaching needs. The high cost of laboratory construction and insufficient practical teaching resources directly lead to the lack of relevant practical teaching links in steel structure curriculum, besides combining with relevant curriculum design to cultivate students' ability to use knowledge.

2. Significance of Virtual Simulation

The tedious theoretical derivation, calculation formulas and normative provisions greatly reduce students' interest in and understanding of relevant knowledge. Therefore, based on virtual simulation technology, it is of great practical significance to reform the new mode of practical teaching of steel structure course and to explore practical and feasible implementation scheme of practical teaching. Combining the finite element simulation technology with the steel structure course teaching, on the one hand, it can display the construction mode and stress mechanism of all kinds of complex nodes and structures in computer software, and on the other hand, it can also realize the stereoscopic observation of the virtual model by adjusting the visual angle. On the other hand, the finite element simulation method can be used to simulate the stress process of the basic components and typical structural systems of steel structures, and the stress process and mechanical performance can be reproduced by computer. At present, many schools have built virtual simulation laboratories, and introduced some virtual simulation software, which has been initially applied in teaching, with remarkable results. Through this virtual experiment teaching, we can ensure that every student can truly participate and improve their practical ability; break the time and space constraints, the experiment content can be more in-depth, and stimulate innovation ability; through the virtual experiment platform, students can design their own experiments and improve their comprehensive ability; some students can participate in scientific research. Develop scientific research ability. The re-

search and implementation of this virtual experimental environment will greatly reduce the cost of laboratory construction, alleviate the adverse effects of safety assurance and budget on the teaching of experimental training, help to cultivate practical operation ability, and have great economic and social benefits. If open experimental teaching platform is introduced and a large number of experimental projects are added, students' comprehensive practical ability will be significantly improved. Combining virtual simulation technology with steel structure course teaching, using simulation software to visually display the instability process of various basic components of steel structure, and according to the needs of steel structure teaching and supporting equipment, setting up online experimental courses, designing various experimental projects for steel structure stability, seismic performance of steel structure, etc. Through finite element simulation of steel structure model, analytical solution simulation and virtual simulation of experimental process operation, the improvement of experimental teaching can be promoted. Students will operate simulation experiment of steel structure according to experimental instruction and complete experimental report online through open experimental teaching platform. Improve students' understanding of various steel structure tests, enhance the understanding of professional knowledge of steel structure courses, and improve students' comprehensive practical ability.

3. The Role of Experimental Teaching Platform

The experimental teaching platform will increase the virtual simulation practice teaching of steel structure course and carry out a large number of simulation experiments. It includes tension compression test, torsion test, pure bending beam test, compression bar stability test, bending test of beams with different sections, welding steel truss test, bending test of steel concrete beams, compression test of steel concrete short columns, shear wall test and so on. The experimental teaching platform includes four parts: material mechanics experiment platform, structural mechanics experiment platform, steel concrete experiment platform and steel structure experiment platform. In the aspect of simulation content, the platform includes five aspects: equipment introduction simulation, experiment principle simulation, experiment scene simulation, experiment operation simulation and finite element simulation. To promote the practice teaching of open experimental teaching platform in Colleges and universities, train students' experimental skills of basic steel structure components and connections, and cultivate students' innovative consciousness and ability. All students carry out on-line virtual simulation of tensile compression test, torsion test, pure bending beam test, compression bar stability test, bending test of beams with different sections, welding steel truss test, steel concrete beam bending test, steel concrete short column compression test. Shear wall experiment. To train students' experimental skills of basic steel structure components and connections, so that students can participate in the whole process from experimental design to experimental loading test to experimental results analysis and summary, greatly mobilize students' enthusiasm to participate in experiments, and cultivate students' practical ability, comprehensive analysis ability and independent problem solving ability. Ability and initiative are fully developed to enhance students' understanding of steel structure and other related courses, and to improve students' comprehensive practical ability.

4. Realizing the Application of Teaching Platform

The study of steel structure course of college students is mostly partial to theoretical teaching, experimental teaching is relatively small, students' interest in learning needs to be improved, and their practical ability needs to be enhanced. Therefore, it is urgent to carry out practical teaching through open experimental teaching platform. In order to realize the application of the open teaching platform as soon as possible, many measures can be taken. According to the experimental mastery of students' steel structure-related courses, a detailed anonymous questionnaire on the experimental situation of civil engineering students can be conducted, accurate data can be mastered, and sufficient preparations can be made for the application of virtual simulation experimental equipment. The universities with open experimental teaching platform, especially those with national virtual simulation experimental teaching center, are investigating the effectiveness of the application of experimental teaching platform in similar universities, learning advanced and successful online experimental teaching experience, and screening out the appropriate experimental teaching platform. Actively collect equipment parameters, declare and implement the introduction of instruments and equipment for open experimental teaching platform. Measures should be taken to ensure that all students in Colleges and universities operate simulation experiments related to steel structures through an open experimental teaching platform, refer to experimental instructions, and complete experimental reports online, so as to arouse their enthusiasm for learning and improve their comprehensive practical ability.

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