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Application of Virtual Simulation Technology in Practical Teaching

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Abstract: The application of virtual simulation technology in practical teaching have been presented in the paper. At first, the existing virtual simulation experiment projects are integrated to form the virtual simulation experiment system for practical teaching. Through the interactive operation mode, students can simulate the whole process of the experiment, intuitively observe and analyze the actual state of the structure which cannot be included in the theoretical calculation. Moreover, in the virtual simulation experiment system, students participate in all the test contents through the interactive operation mode, understand the whole process of the experiment, and improve the students' ability and consciousness of team division and cooperation. In the end, in the virtual simulation experiment, the operation time of students is reduced, and can be repeated. A single person can complete the whole process, which greatly reduces the dependence on the instructor and improves the ability of students to solve complex engineering problems independently.

1. Introduction

According to the requirements of civil engineering professional certification, experimental practice teaching needs the participation of all students. “Engineering structure test” is a summary of structural tests in civil engineering specialty, which is of great significance to cultivate professional and technical personnel who meet the professional certification standards. However, there are still some problems in the process of implementation.

1.1 It is Difficult to Carry out the Experiment

There are many problems in the physical test, such as large volume, long preparation time, high risk and many test contents. At the same time, a large number of service objects, a relatively serious lack of teachers, and the experimental object is relatively fixed and single, resulting in the experimental project still cannot be implemented in the curriculum. [1]

1.2 There Are Some Deficiencies in the Design and Innovation of the Experiment

At present, most of the experimental courses or projects in the laboratory are basic,

demonstrative and verifiable. Although they can meet the teaching requirements of professional norms, the proportion of design and innovation experimental projects for students to master professional knowledge and improve their skills is seriously insufficient, and the cultivation of students' practical and innovative ability is insufficient.

1.3 Students' Enthusiasm and Participation Are Insufficient

In the new era, students are willing to master knowledge through their own attempts and personalized operations. Repetitive, deterministic and demonstrative experimental projects are obviously not attractive to students. Students' participation is not high and their enthusiasm is low. [2]

The above problems show that the teaching reform of “engineering structure test” for civil engineering specialty must be carried out, especially this epidemic situation can better reflect the necessity and urgency of the construction of virtual simulation system for experimental teaching [1, 3]. With the development of information technology, the increasing requirements for experimental teaching in colleges and universities, and the leading role of the virtual simulation experimental teaching center of the Ministry of education, the application of virtual simulation experimental teaching in colleges and universities is increasing. Its advantages are not limited by time and space, saving consumables, small investment, quick effect and wide teaching radiation, which can alleviate the “bottleneck” of experimental teaching resources [3].

2. Research Contents

Based on the development of a single virtual simulation test project, the teaching system reform of engineering structure test based on virtual simulation technology is carried out, which can serve the experimental teaching needs of structural mechanics, material mechanics, concrete structure design principles and other courses. The specific research contents include:

2.1 Integrate the existing virtual simulation experiment projects, and develop new virtual simulation experiment projects according to the needs to form the virtual simulation experiment system of engineering structure test.

2.2 Reform the experimental teaching system, relying on the network teaching platform, do a good job in the design and connection of pre class, in class and after class learning tasks, so as to achieve the integration of pre class, in class and after class learning activities, and fully reflect the essence of “task-main line, teacher-led, student-centered”.

2.3 Through the whole path teaching process of engineering structure experiment, students can participate in the whole process of actual engineering structure model experiment in limited class hours.

2.1 Reform the Experimental Teaching Method, Combine the Virtual with the Real, and Improve the Students' Experimental Participation.

2.5 Reform the evaluation method and system of experimental teaching, personal evaluation of the achievement of practice teaching objectives, and change the problem of “mixed” scores of some students in group experiment, so as to make the evaluation of students' achievement of individual curriculum objectives more objective and reasonable [4].

2.6 Extension and expansion of traditional teaching: highlight the “combination of theory and practice”, effectively guide the cultivation of students' innovative thinking, and promote the cultivation of students' practical innovation ability [5].

3. Current State

By using virtual simulation technology, the experiment teaching system reform was carried out. At present, the virtual simulation program of some test items in engineering structure test has been developed. A single virtual simulation test project provides a foundation for the reform of the teaching system of engineering structure test.

The virtual simulation test projects have been completed, including:

Fig.1 Virtual Simulation Project of Reinforced Concrete Beam Preparation Process

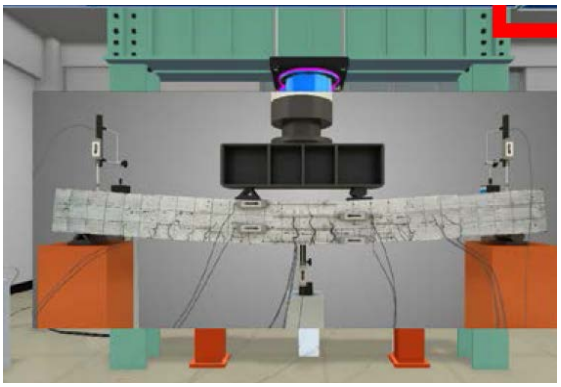

Fig.2 Virtual Simulation Project of Normal Section Bending Test of Reinforced Concrete Flexural Members

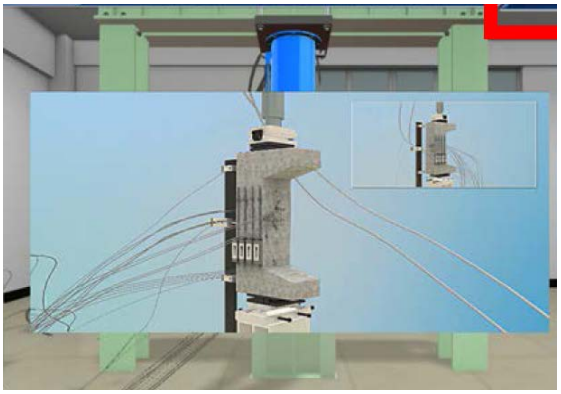

Fig.3 Virtual Simulation Project of Eccentric Compression Test of Reinforced Concrete Short Columns

Fig.4 Virtual Simulation Project of Steel Truss Stress Test

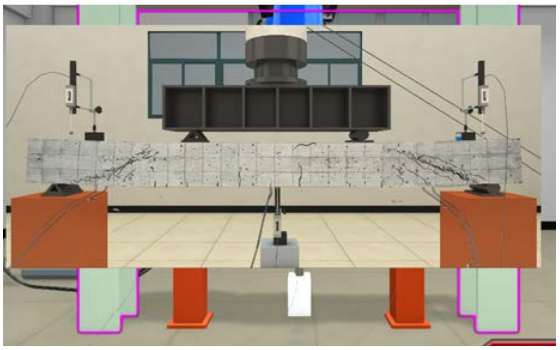

Fig.5 Virtual Simulation Project of Inclined Section Shear Test of Reinforced Concrete Beams

The ultimate goal of this project is to rely on the existing and to be developed virtual simulation projects, based on virtual simulation technology. The reform of the teaching system of engineering structure test can serve the experimental teaching needs of structural mechanics, material mechanics, concrete structure design principles and other courses, solve the problem of insufficient participation of students in the experiment, combine the virtual with the real, improve the teaching effect, and form a good complementary with the theoretical calculation of the course.

4. Implementation Plan

At first, the research in the field of virtual simulation teaching will be investigated, the data will be collected and sorted out, and the construction ideas will be clarified;

Then, the virtual simulation experiment project to be developed will be completed;

After that, all the single virtual simulation experiment projects are integrated to form the experimental course teaching system of engineering structure test;

At last, the experimental teaching method and evaluation system were reformed and applied to the course of civil engineering experiment. Meanwhile, the courses of concrete structure design principle, structural mechanics and material mechanics were promoted and evaluated.

5. Conclusion

(1) Form the virtual simulation experiment system of engineering structure test, and build the experimental teaching system of engineering structure test based on virtual simulation technology.

(2) The reform of experimental teaching methods, the use of interactive technology, to achieve multi task, repeatable operation, enhance students' experimental participation, in the virtual environment to achieve “everyone hands-on, full participation” teaching objectives.

(3) Reform the experimental teaching evaluation system, and realize the reasonable evaluation

requirements of civil engineering professional certification for the achievement of curriculum objectives.

(4) Through the combination of virtual and reality, theory and experiment of virtual simulation experiment and structural in-situ experiment, the requirements of civil engineering professional certification for students' innovative thinking cultivation and practical ability training are realized.

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