

## Application of Virtual Simulation Technology in Mechanical Majors of Applied Undergraduate Colleges

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### Abstract

With the help of virtual simulation technology, a new path of experimental teaching reform of mechanical specialty is proposed. The virtual simulation experiment teaching technology for mechanical majors adheres to the teaching main line of "learning-practice-using-creation", and introduces the concept of "combining the virtual and the real, complementing each other, being able to be true, and using the virtual to help the real" into the teaching of professional courses. A new model of college experiment teaching with three levels of "theory teaching-virtual experiment-laboratory teaching" has been proposed. The results show that, through the development of virtual simulation experiment teaching, many problems that are difficult to perform in experiments or cannot be reproduced in reality can be solved, such as principle demonstration, animation simulation, action mechanism simulation and virtual test, and the engineering problems can be reproduced through virtual scenes, that is to create a virtual real environment. Finally, explore the effective ways and methods of virtual simulation platform, and use virtual simulation platform in teaching to improve students' interest in learning, reform students' learning methods, and cultivate students' ability of independent learning and innovation.

### Keywords

Virtual Simulation; Mechanical Major; Applied University; Combination of Virtual and Real.

### 1. The Current Teaching Situation of Mechanical Experimental Courses

Experimental teaching is an important part of the teaching of mechanical majors in colleges and universities, and it plays an important role in cultivating students' innovative consciousness and improving students' innovative ability [1-3]. As the country continues to increase the demand for applied undergraduate talents, new experimental teaching requirements are also put forward for talent training. However, from the current situation, due to the lack of capital investment and configuration, the development of experimental teaching is limited, and some experimental projects are not suitable for physical teaching. Therefore, in order to meet the country's demand for talents, colleges and universities have begun to actively build virtual simulation experimental platforms, in order to carry out the experimental teaching well and improve the effect of experimental teaching[4].

At the same time, the department of higher education of the education ministry decided to carry out the construction of a national-level virtual simulation experimental teaching center in the "Notice on the Construction of a National-level Virtual Simulation Experiment Teaching Center", which triggered a round of internet technology, virtual simulation technology. The unprecedented changes in the field of experimental teaching such as reality technology and educational technology have promoted the wide application of virtual simulation experiments in teaching[5-7]. Luliang university as a local application-oriented College, mainly cultivates application-oriented professionals who are connected with regional enterprises. However,

professional ability is the foundation of application-oriented professionals. It is the urgent task of colleges and universities to explore and promote the professional ability of mechanical college students and improve the new teaching mode under the background of new engineering [8].

However, the experimental teaching mode of the mechanical major of Luliang College is still largely stagnant in the teacher-centered, that is, the class teaching mode mainly relies on teachers to speak and students to listen. The biggest disadvantage of this model is that students, as cognitive subjects, are always in a passive position in the teaching process, and their initiative and enthusiasm are difficult to exert, which is not conducive to cultivating students' innovative spirit and practical ability, and is not conducive to applied innovation of cultivation talents [9]. As for students' ability of information acquisition, information analysis and processing, due to the limitation of traditional classroom teaching conditions, students lack a learning environment for active exploration, active discovery and conclusion. It can be seen that the traditional monotonous classroom teaching has become less and less suitable for the rapid development of contemporary society. With the advent of the information age, it has become a necessity to introduce virtual simulation technology and network environment into education and teaching [10-11].

To sum up, it is of great significance to apply virtual simulation technology to mechanical experimental teaching in applied undergraduate colleges, build corresponding experimental platforms, develop relevant experimental project, and gradually popularize and apply them in teaching practice. The introduction of virtual simulation experiment teaching can meet the needs of application-oriented undergraduate colleges and universities to cultivate modern talents, and it is also the need for colleges and universities to improve the comprehensive competitiveness of mechanical students in the workplace.

## **2. An Overview of Virtual Simulation Methods for Mechanical Majors**

Mechanical virtual simulation experiment teaching mainly includes conventional experimental teaching and computer-aided simulation experiment teaching. Due to the problems of imperfect laboratory equipment, long experimental period and outdated equipment in applied undergraduate colleges, some experimental teaching cannot be carried out smoothly. The mechanical major is very practical, and the simple theoretical course explanation cannot achieve the expected teaching effect. Relying on simulation technology and network technology to establish a virtual simulation experiment teaching system can better cultivate mechanical application talents that meet social needs. Aiming at this kind of situation, it is proposed to apply virtual simulation technology to the experimental teaching of mechanical majors. Teachers use the virtual simulation experiment teaching platform to optimize the classroom teaching of practical training, break through the key points and difficulties of teaching, mobilize students' enthusiasm for learning, actively participate in teaching, and learn the methods and skills of learning with pictures and texts, flexible and vivid animation effects, so as to cultivate students' innovative thinking.

The virtual simulation experiment teaching technology for mechanical majors adheres to the teaching main line of "learning-practicing-using-creating". Application and creation are improved on the basis of learning and practice. Through the practice of virtual simulation experiment platform, we will carry out innovation and entrepreneurship education and training, innovate mechanical product design, innovate course platform, and then innovate thinking. The concept of "combining the virtual and the real, complementing each other, being able to be true, and helping the real with virtual" is introduced into the teaching of professional courses, and a new experimental teaching mode suitable for application-oriented undergraduate colleges and universities is proposed.

### **3. Mechanical Professional Virtual Simulation Application**

#### **3.1. Construction of Virtual Simulation Experiment Teaching System for Mechanical Majors**

The construction of the virtual simulation experiment teaching system for mechanical majors adheres to the principle of "learning-practice-using-creation", and introduces the concept of "theoretical courses add experiments" into the teaching of professional courses. A new mode of college experiment teaching with three levels of "theory teaching-virtual experiment-laboratory teaching" was proposed, and the following problems were solved by means of virtual simulation experiments:

- 1) Carrying out the pre-operation of various experiments on the virtual simulation experiment teaching platform can effectively reduce the loss of physical experiments and improve the success rate of experiments;
- 2) For various types of experiments that are comprehensive, innovative and difficult to implement on-site, the virtual simulation platform can be improved by continuously modifying the parameters of the experimental model, reorganizing the experimental model, etc., which meets the flexibility requirements of experimental teaching and improves the experimental efficiency, and the experimental cost and consumables are greatly saved.

#### **3.2. The Application of Virtual Simulation Experiment Teaching in the Teaching of Mechanical Major Courses**

Virtual teaching has high efficiency, low cost and rich content, and can be easily combined with other advanced teaching methods. In the teaching of professional courses, due to limited conditions, there are many experiments that are difficult to perform or the real state cannot be reproduced, such as engine assembly, gearbox parameter modular assembly experiments, mechanical deformation, etc., and the stress distribution of components is difficult to be visually see. Through the development of virtual simulation experiments, the above problems are solved with principle demonstration, animation simulation, action mechanism simulation, virtual testing, and engineering problems are reproduced through virtual scenes to create a virtual and real environment to stimulate students' enthusiasm for learning and innovation potential.

#### **3.3. The Application of Virtual Simulation Experiment Teaching in the Graduation Design of Mechanical Majors**

Virtual simulation experiment teaching can improve students' ability of using the software, such as, SolidWorks, Ansys, Abaqus and other software. And combine practical techniques to analyze and deal with practical problems in the process of machinery manufacturing, installation and maintenance. Students can use 3D software such as SolidWorks for structural design, mechanism motion simulation, and compare and judge whether the theoretical derivation is correct. On this basis, Ansys software is used to check the strength of important components. Through such a complete process of scheme design, motion simulation, structural design, and strength analysis, the technical development process of mechanical products is better represented. Through the training of graduation design, students can also improve their own graduation design quality and design ability.

#### **3.4. Application of Virtual Simulation Experiment Teaching in Innovative Design Practice and Discipline Competition of Mechanical Majors**

Adhering to the drive of innovative design and subject competition, virtual simulation teaching encourages students to independently develop and innovate design, and cultivate students' teamwork and engineering literacy. In competitions such as college student innovation training

competition and mechanical innovation design competition, it is generally necessary to make real objects or models. If the parts are only made and assembled on the basis of the two-dimensional engineering drawings, there is usually a high possibility of errors. It is very likely that the parts are manufactured with wrong dimensions, assembly interference, etc., resulting in the failure of the model making, and the re-production will greatly increase the cost. affect the progress of the competition. By applying virtual simulation to scheme verification, kinematic dynamic simulation and optimization design, it can improve design efficiency, facilitate rapid modification and optimization of design schemes, and ensure the first-time success of parts fabrication and assembly, which can not only save time and production costs, but also improve competition performance.

At the same time, the virtual simulation experiment teaching system will organize teachers and students who are interested in software simulation to form a united young and energetic virtual simulation team, encourage everyone to make bold innovations, dare to think, dare to do. Train students' engineering practice ability, cultivate students' engineering literacy, and establish engineering concept from both hard and soft aspects.

#### 4. Conclusion

(1) Through the investigation and research on the mechanical major in application-oriented undergraduate colleges and universities, summarize the theory, technology, methods and means of optimizing the subject experimental teaching by using the virtual simulation experiment teaching platform, and improve the teaching quality of the mechanical major and related majors in Luliang College, to train excellent engineers.

(2) The construction of virtual simulation experiment teaching platform and resources can be organically combined with the actual physical experiment teaching resources to improve the systematization of experimental teaching resources. The virtual simulation technology is used in the construction of the experimental platform. In addition to the original physical experimental projects, various virtual simulation experimental projects are newly added, and most of the newly added virtual simulation experimental projects are derived from actual typical mechanical engineering projects, effectively reproducing the experiments. It can improve the operability of the experiment, enhance the fit of the experimental project and the theoretical teaching content, and the virtual experiment and the real experiment can complement each other well, promote the improvement of the overall teaching effect, and gradually improve the students' hands-on operation. ability and comprehensive ability.

(3) Through the relevant research of this paper, improve the students' ability to use SolidWorks, Ansys, Abaqus and other software, to further enhance the practical ability and innovation ability, improve the application ability of information technology, make students adapt to the current society's requirements for mechanical professionals, and gradually promote it in the graduation design of mechanical majors.

(4) Develop students' creative thinking and guide students to actively participate in mechanical innovation design and production activities and competitions. At the same time, improve students' use of the experimental platform, create some innovative training project, encourage students to actively participate, and allow students to gradually improve their innovative awareness and ability in the process of practice.

(5) Through the research of this paper, the research level of teachers can be improved, the communication and cooperation among teachers can be strengthened, and the effective combination of personal reflection, peer mutual assistance and professional guidance can be realized, and an efficient research team can be formed.

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