

# Research and Analysis on the Application of Virtual Laboratory in Teaching

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## ABSTRACT

Due to the rapid development of computer and network communication technology, the virtual laboratory has been generated and applied in various fields, and its application in the field of education has been promoted rapidly. This paper introduces the difference between traditional experimental teaching and virtual experimental teaching, the design idea of virtual experimental platform and the analysis of its application in teaching. The use of the virtual laboratory for experimental teaching can improve safety and save resources, enrich teaching content, and effectively stimulate students' interest in learning. It has facilitated the reform of teaching forms, teaching methods and teaching concepts, and it is a new development direction of teaching.

**Keywords:** virtual laboratory, experimental teaching, computer foundation

## 1. INTRODUCTION

As early as the 1960s, virtual reality technology has already appeared[1-2]. As processor technology, graphics rendering technology, digital signal processing technology, and sensing technology develop rapidly, virtual reality has become a research focus and is widely used in education, military, medicine, design, architecture, entertainment and other fields[3-5]. Virtual experiment refers to the creation

of related software and hardware operating environments on the computer that can assist, or replace (partially replace) the traditional experimental operation links by means of multimedia, simulation, virtual reality and other technologies. In this way, experimenters can complete various experimental projects just as in the real environment, and the experimental effect is equivalent to or even better than that obtained in the real environment[6-8].

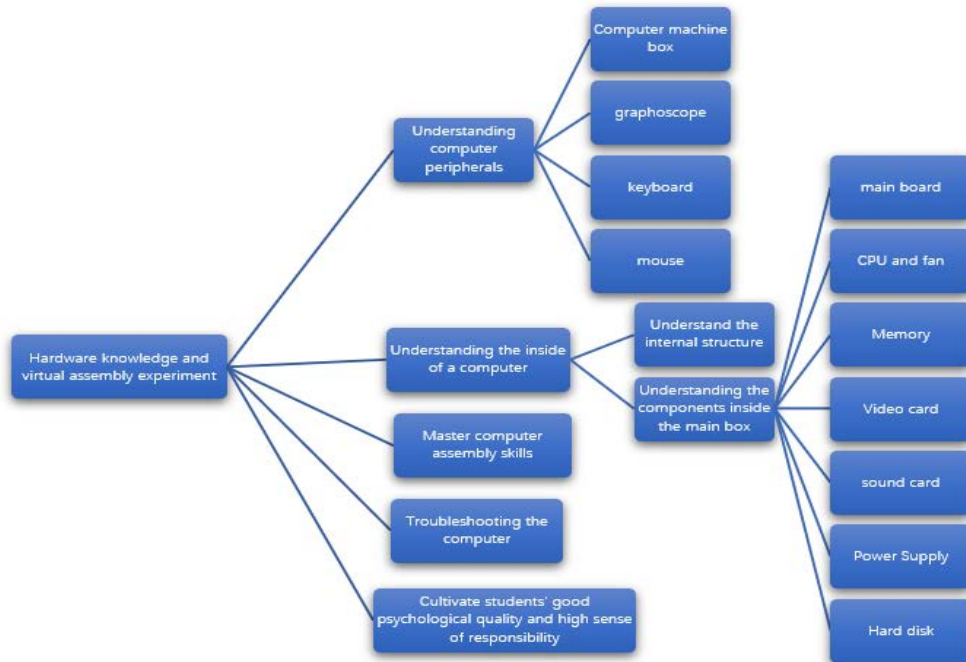


Figure 1. Teaching objectives

In the college computer public basic courses, there is a part of computer system composition and installation content.

Through the study of this part, students will learn the latest technology of current computer hardware development,

master the composition, working principle and performance index of each computer component, and master the installation method of each computer component. The teachers make use of the virtual laboratory to carry out teaching, replace the hardware in reality with realistic three-dimensional models, and build a dynamic and simulated computer hardware assembly platform with the organic combination of sound, text and animation[9-11]. The interactive content in the platform can satisfy students to observe and learn from all angles. By dragging and clicking the mouse and cooperating with the number keys of the keyboard, students can have an immersive feeling, improve their interest in learning and promote their active learning. And it is conducive to students' mastery of knowledge points and the completion of learning goals[12-14]. The specific teaching objectives are shown in Fig. 1.

## 2. DIFFERENCE BETWEEN THE TRADITIONAL EXPERIMENTAL TEACHING AND THE VIRTUAL EXPERIMENTAL TEACHING

In the teaching of traditional computer experimental courses, teachers first assign the experimental tasks of a class, and then demonstrate the experimental content while making explanations. After the demonstration with explanation is over, students themselves operate the experimental content and upload the finished experimental works to the teacher's machine, and finally the teachers make corrections and evaluations, as shown in Fig. 2[15-16][7]. From this process, it can be seen that, during the process of teachers assigning experimental tasks, explaining and demonstrating experimental content, and evaluating and correcting students' work, students are just a tool for accepting knowledge passively, and they can only interact with teachers when carrying out the experimental content by themselves. In such a learning mode, students will surely feel boring about the content they learn[18-19].

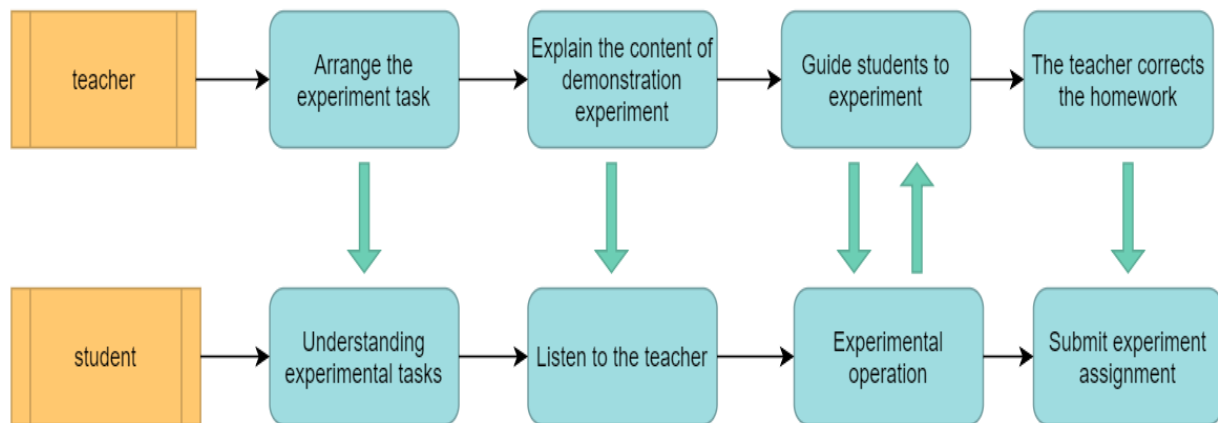


Figure 2. Traditional experimental teaching mode

However, making use of virtual experiments to carry out teaching has changed students' passive learning state. In the whole experiment process, teachers only need to show the tasks and experimental results at the beginning, so as to enable students to understand the experimental objectives. And the decomposition steps to complete the tasks can be presented to the students by means of words, pictures and other forms. Since there is not just only way to complete the experimental tasks, teachers can be responsible for introducing some other innovative approaches for the completion of the tasks, and finally, achieve comprehensive improvement based on the students'

experimental situation. In this teaching mode, students need firstly clarify their tasks and try to complete the tasks according to the decomposition steps provided by teachers. After truly mastering the relevant knowledge points, students themselves can form certain skills and expand the tasks in accordance with their skills. As can be seen, in the entire experiment process of using this virtual experimental teaching form, teachers and students can communicate most of the time, from which, students have a kind of learning initiative, changing from passive learning to active learning[20-22]. The specific steps are shown in Fig. 3.

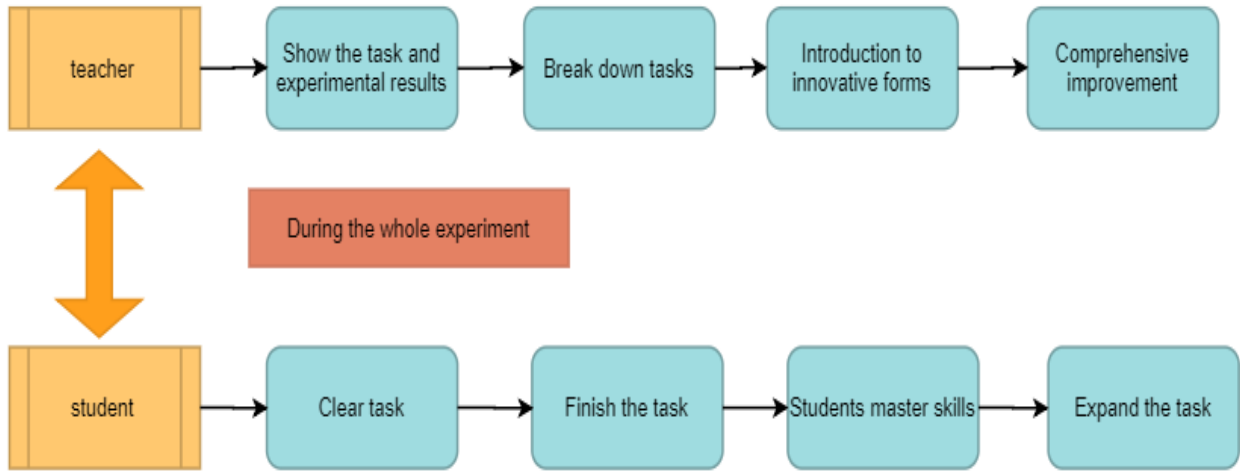


Figure 3. Virtual experiment teaching mode

### 3. INTRODUCTION TO THE VIRTUAL EXPERIMENT PLATFORM DESIGN

Before designing the virtual experimental platform scene, the first thing to be clarified is the working principle of the computer system, which is a very critical step. Only when the working principle of the design object is clear can the scene structure of the platform be scientifically designed. And it is necessary to sum up the teaching key points and difficulties of this part of the knowledge points based on many years' front-line teaching experience. Then the design of the virtual experimental platform scene can be started. The scene design is mainly divided into two parts. First, the design of the computer laboratory environment. Given that this platform is mainly used for computer hardware recognition and assembly experiments, the emphasis is put on the realization of computer hardware modeling and hardware assembly functions. For the virtual laboratory environment of computer assembly, only a blue background with lighting effect is designed. Second, virtual computers assemble hardware devices. In the process of virtual laboratory scene design, the main concern is that the virtual object must reflect the physical characteristics of the real object. For example, if the video card is not plugged in, there will be nothing exposed to the display when the power button is pressed. At the same time, it is also necessary to take into account the reality of the virtual object appearance, which is mainly reflected in the length, width, height, color and other characteristics. This computer experimental platform mainly adopts software for 3D modeling, and some complex hardware (such as the motherboard) adopts the form of mapping. According to the design purpose of this experimental platform, the main scene design is as follows:

- a) Open the computer assembly virtual platform and what is presented to the user is a blue background with a lighting effect and the mainframe case. Because this platform is mainly for students to master the operation of computer assembly, the background is designed with a clear and simple blue background.
- b) Press the key F3 to open the case door, press the number key 1 to choose to show or hide the hardware, and press the number key 2 to choose to automatically install the corresponding hardware. The installation process can also be completed by dragging the mouse. After the hardware is installed, it is necessary to go to the next scene.
- c) Press the display button, and then press the power button of the mainframe case. If the entire computer assembly process is correct, it can display the start-up picture normally, and enter the desktop. If the computer assembly process is incorrect, the computer cannot start normally, and there will be a corresponding error message.
- d) At the same time, there is a scene that is convenient for teachers to teach. It can realize the gradual hiding of the computer case, and facilitate students to clearly understand the installation position of each hardware in the computer case.

### 4. ANALYSIS OF TEACHING APPLICATION

As college computer public basic courses are designed for all freshmen, there are a large number of students in the class, and it is difficult for the school to provide students with computer hardware for the learning. The past teaching process was completed in the form of PPT

presentation and teacher's language solution, and the final teaching effect is not good. When teachers carry out the teaching in the form of virtual experimental platform, it not only enables students to deeply understand the hardware components of the computers, as well as their functions and performance standards, but also makes them to identify all kinds of hardware. It can also cultivate students' ability of independent learning, inquiry learning and cooperative learning, as well as their habit of exploring the unknown world and learning actively.

In the computer assembly virtual platform, students can observe the various components (motherboard, memory, video card, hard disk, CD-ROM, power supply, etc.) inside the case from a 360-degree angle. They can complete the assembly process in the virtual simulation platform just like assembling a computer in reality, and they can also check whether the installation is successful after the completion of the assembly. The students are quite excited throughout the learning process and develop a keen interest in learning the content of this part. Cooperating with teachers' active guidance and students' use of internet network means, students can quickly master the learning content of this part of the knowledge points in the communication.

After the class, when teachers communicated with students, some students gave feedback: "I have never learned through the virtual platform before, and I think this learning method is intuitive and interesting. I hope teachers can also use more virtual experiments in class." There were also some students saying: "The models in the computer are the same as the real ones. It is amazing, just like completing the entire learning in a game."

## 5. CONCLUSION

Due to the rapid development of computer and network communication technology, the virtual laboratory has been generated and applied to education, games, shopping and other fields. Using the virtual laboratory for experimental teaching is a new development direction of teaching. It has facilitated the reform of teaching forms, teaching methods and teaching concepts. The construction of a virtual experimental platform suitable for college computer basic courses can overcome the deficiency of traditional teaching, effectively solve the problem of insufficient resources in teaching, improve teachers' quality of experimental teaching and comprehensively enhance students' practical ability and innovation.

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