

Experimental Teaching Research based on Virtual Simulation Electronic Laboratory

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Abstract. With the continuous development of China's higher education and the continuous advancement of the teaching reform of traditional electronic courses, some defects and shortcomings of traditional experimental instruments in electronic experiment teaching are increasingly apparent. The teaching methods of electronic experiments using virtual simulation electronic laboratories have attracted more and more attention. In this paper, the comparative research and analysis of traditional experimental teaching and virtual simulation electronic experimental teaching prove that the teaching method based on virtual simulation electronic laboratory can be well combined with traditional experimental methods on experimental teaching.

Keywords: Virtual simulation; Electronic experiment; Teaching; Research.

1. Introduction

Experimental teaching is one of the indispensable links in the electronic course. Experimental instruments, as the basic tools of electronic experiments, directly affect the experimental results of students. In the traditional electronic laboratory, the common instrument is used for the experimental operation. In the early stage, it is necessary to purchase enough instruments and meters, and the experimental precision is not high in the actual operation process. In the later stage, it takes a lot of manpower and resources to carry out maintenance. The use of virtual electronic laboratories can greatly reduce the cost of experiments, and its experimental accuracy is much higher than that of instruments in ordinary laboratories. The use of virtual simulation electronic laboratory for virtual electronic experiment teaching has been widely recognized by domestic electronic professional teachers.

In recent years, the application of virtual electronic simulation software [1] in the teaching of electronic courses in China has also received extensive attention. Many colleges and universities have established their own virtual simulation teaching laboratories. The first-line teachers of electronic course teaching also constantly contacted the application simulation software and introduced it into the traditional theory teaching to assist the teaching. Various related teaching materials began to emerge in large numbers; the latest goal of the national education reform also clearly proposed to integrate informationization with the curriculum. The virtual simulation laboratory will become more and more popular in electronic teaching.

2. Status of Traditional Experimental Teaching

At present, due to the variety of electronic circuit teaching content and insufficient class time, most students can't master the design, installation and debugging of the actual electronic circuit hardware and software. Some students don't even know the common devices. The main reasons for the investigation are as follows:

2.1 Outdated Teaching Mode

The teaching of electronic circuits is taught in the traditional sense. The experimental part of the hands-on operation is almost in the same form as the textbook. The specific experimental operations are carried out for specific knowledge points, and the actual connection is not close.

2.2 Students' Self-learning Ability and Hands-on Ability are not Strong

The experimental models are independent closed modules that are customized for a specific experiment. When students conduct experimental operations, they only need to connect the block circuits with wires according to the contents and steps in the guide. Few students study the internal circuit of the experiment, less people to analyze the specific role of each component in the experiment. Because the students usually have weak hands-on ability, there will be problems of damage to the equipment components such as reverse polarity of the capacitors and excessive solder joints in the circuit board.

2.3 Old Experimental Equipment

Some experimental equipment is outdated, insufficient in quantity, and cannot be repaired or updated after partial damage. The cost of purchasing traditional electronic laboratory instruments is relatively high, and the instruments are easily damaged during the experiment, and safety cannot be guaranteed. It is some important factors that restrict the teaching of electronic experiments. If it cannot be effectively solved, it will seriously affect the teaching effect.

3. The Virtual Simulation Electronic Laboratory Features

3.1 High Performance of Virtual Simulation Electronics Laboratory

The foundation of the virtual simulation electronic laboratory is computer technology, which takes all the advantages of computer technology, such as excellent processors in computer technology. The application of these technologies can make the system calculate some complicated high-speed without pressure. The data and results allow the experimenter to quickly obtain accurate data.

3.2 The Virtual Simulation Electronics Laboratory has Strong Scalability

The application of virtual simulation electronic laboratory makes electronic experiment teaching no longer limited to the current technology, and has strong scalability [2]. Because virtual instrument software is very flexible, students only need to update the software in a timely manner to improve the entire system, and the cost is very small, which allows students to access new virtual instruments more quickly.

3.3 Virtual Instrument Development Time is Short

Virtual instrument technology as a software technology, its development is very time-saving. At present, the functions of common electronic experimental instruments are more and more complicated. In order to meet the needs of experiments, students usually need to measure all kinds of instruments involved in the whole experiment process, and the completion of these tasks takes a lot of time and effort. The application of the virtual simulation electronic laboratory can solve this problem well. By using virtual instruments for electronic experiments, the complexity of the experiment can be effectively reduced, the operation time is greatly saved, and the experimental process is more convenient and quicker.

3.4 Virtual Instruments can be Seamlessly Integrated

Virtual instrument technology has very good drive and application optimization. Virtual instrument technology can be used to seamlessly integrate computer systems and various experimental instruments, allowing students to experience a highly flexible operation experience and versatility. The powerful experimental content is very convenient for students.

In summary, only by improving the current traditional experimental teaching mode and applying the virtual simulation laboratory to the student experiment, can we achieve breakthroughs in the experimental teaching of electronic circuits, thereby improving the design level of students' electronic circuits and enhancing students' innovation and practical ability.

4. Application of Virtual Simulation Lab in Electronic Experiment Class

(1) Teachers can design teaching modules in the virtual simulation laboratory, explain the working principle of various virtual instruments in depth, and introduce their corresponding operation methods in detail, so that students can fully grasp and understand the specific characteristics of each virtual instrument and to lay a good foundation for learning the actual experimental operation. Taking the teaching of “Common instrument and meter practice” as an example. In order to accurately measure the data and observe the experimental phenomenon during the experiment, it is necessary to learn to use these instruments correctly. These experimental instruments such as oscilloscopes, function signal generators/counters, DC stabilized power supplies, and digital multimeters have small operation interfaces, and it is not convenient to perform a wide range of demonstrations during operation. At this time, the virtual experiment instruments can be conveniently displayed. The working principle of a virtual instrument is explained and introduced easily by teachers. Teachers can also design many teaching modules in the virtual simulation electronics lab for students to practice after class. For example, the basic amplifying circuit is a basic circuit unit. Correctly analyzing and mastering the amplification characteristics of the basic amplifying circuit is the basis for science and engineering students to learn complex electronic circuits. Using the virtual instrument of the virtual simulation laboratory to conduct electronic experimental teaching circuits enables students to observe the entire process of the amplified signal of the amplifying circuit more dynamically.

(2) The virtual simulation electronic laboratory is combined with the network facilities to design a comprehensive electronic experiment [3][4]. This is a new type of electronic experiment, specifically an electronic experiment that combines virtual instrument technology and network technology to work together. The new electronic experiment is assisted by relevant teaching software, and the data obtained in the electronic experiment is imported into the computer, and then the detailed analysis and measurement are performed by the virtual instrument, and finally the student is presented through the network facility. At the same time, it can be considered to form a network electronic laboratory that uses virtual instruments for experimental operations, so as to facilitate students to build their own experimental systems after class, so that students can fully and independently design various course experiments and conduct comprehensive experiments.

5. Conclusion

In general, the use of virtual simulation electronics laboratory for electronic experiment teaching can not only save costs, but also improve the quality and efficiency of teaching. The teaching of electronic experiments should put the comprehensive ability and comprehensive quality of students in the primary position, which is the fundamental purpose of experimental teaching. Ordinary electronic experimental instruments and their related teaching methods are relatively old and backward, and can no longer adapt to the current teaching environment, which has greatly restricted the development of students; nowadays, schools use virtual instruments for electronic experiment teaching, not only It can make up for these shortcomings, and it can also make the electronic experiment teaching process more perfect, thus improving the quality and efficiency of teaching.

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References

- [1]. Li Zhiwei, Wei Cong, Huang Wei, et al. Research on the application of MULTISIM software in e-learning[J]. *Electronic World*, 2013(13): 170-170.
- [2]. Fang Jian, Liu Yali. Application of Computer Simulation Technology in Digital Electronic Technology Teaching[J]. *Communications*, 2017(23): 362-362.
- [3]. Ren Shuang, Guo Jinyu. Practical Research on Teaching Method of Electronic Experiment Course[J]. *Science and Technology Innovation Review*, 2015(36): 247-247.
- [4]. Ren Shuang. Research on Teaching Reform of Electronic Experiment Course Based on "113" System[J]. *Science and Technology Innovation Review*, 2017(19):241-242.