Application of virtual simulation experiment system in instrumental analysis teaching in colleges

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Abstract. With the rapid development of computer information technology, the virtual simulation technology is coming as the times require. In recent years, due to its good interactivity, versatility and openness, virtual laboratories have received increasing widely attention in the field of instrumental analysis experiment teaching. The current teaching demonstration is limited by the laboratory equipment, resulting in a lot of students fell behind the class. Combined with the advantages and experimental teaching characteristics of virtual simulation technology, a set of virtual experiment teaching system was designed. The system includes experimental purposes, experimental content, experimental principles, teaching animations, virtual operation training, precautions, and experimental virtual tests. The virtual experiment teaching system can be used as an important supplement to the experimental teaching, and improve teaching effects.

Keywords: Virtual laboratory, Instrumental analysis, Experiment teaching, Virtual reality.

1 Introduction

The basic goal of engineering education is to develop students' practical ability. At present, students in the engineering colleges and universities are generally have problems in practical ability. Colleges and universities should lay emphasis on the cultivation of students' experiment skills. Instrumental analysis experiment as a basic course can stimulate the learning interest, motivation, and a good way to train the thinking ability of the students. Experiment teaching is different from other disciplines in teaching methods, it pays more attention to the cultivation of practical skills. However, due to the limited supplies and equipment, teachers always asked the students to do the experiment in groups in traditional classes. This makes the students were too inexperienced and too inexpert to succeed in operating an instrument. These contradictions seriously affect the quality and effectiveness

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of instruments education. Thus, combining with teaching practice, a virtual instruments is carried out on accelerating cultivation of practical talents.

Virtual simulation technology[1,2] is a computer simulation system that can simulate three-dimensional dynamic space and the multi-sensory experience creates good participation and maneuverability. The application of virtual reality technology in instruments analysis education has very important practical significance. Virtual Simulation Experiment System for teaching the theory and experiment to provide a virtual experimental teaching demonstration platform.

The purpose of this article is to study the application of virtual simulation technology in instruments teaching experiments. The research is based on research of experiments theories methods about the network education. The application of virtual experiment system can provide a feasible way for colleges. Using these computer simulation technologies for teaching, freshman training, skills testing, technical learning, experiments planning, and other aspects enables students to fully devote themselves to the virtual environment and interact with various objects in the environment. It has been a good way to solve the resource shortage problem and to promote the improvement of teaching and teaching quality improvement.

2 Structure and design principle

Experiment is an important model of instrumental analysis teaching[3-5]. It is an important part of cultivating and training learners' thinking, skills, and practical work ability. The virtual LAB teaching platform and system are mainly using virtual reality technology and open internet terminals to realize the digitization and virtualization of laboratory teaching, so that students can learn and operate in a virtual experimental environment. On the one hand, it can effectively enhance students' interest and on the other hand, it can also reduce the instruments.

The virtual simulation system covers the entire process of instruments' experiments completely. Students can conduct detailed and standardized procedures. It contains a number of sections, the virtual environments, the virtual instruments, and virtual devices. The virtual environments also include instructional animations, virtual training and virtual testing. The whole structure of the research is described as figure 1.

The primary mission of the virtual simulation experiment system is to offsets deficiency of traditional teaching mode and the teaching process could be more interacted and immersed. The experimental procedures must be clear what should do first and what to do next, reducing unnecessary operations and could be helped to develop good experimental habits. The students' knowledge reserves and the cognitive development of things should take into account in the design of the virtual simulation experiment.

Our system follows these principles.

2.1 Facticity

"Facticity" is the core principle on how to figure out the characters in the virtual simulation experiment system. Students can learn the sense of knowledge and learn some experience in practice by the virtual reality technology. Using the virtual reality system for experiment teaching can be immersive learning and more interested in instruments learning; by processing the abstract theories in image, it makes the knowledge easier to understand. Students can complete the series of steps such as experiment design, operation, and result analysis as if they are on the scene. The result shows virtual reality system plays a significant role in experimental teaching, that practice can promote the formation of experimental operation skills, especially in automation operation.

2.2 Interactivity

The prompt feedback and the strengthening of the testing technique ability are main elements to influence the promotion of the skilled from the immature ones. At its core, interactivity is the result of the transfer of information on a page. People need feedback when learning new skills. In teaching and the course of training, it is the key of promoting the teaching records to find out the existent problem promptly and correct them in every technical link. As the main body of learning, students can learn independently through virtual simulation experiment software. Students can also perform more in-depth of a certain part, and intuitively characteristics, functions and other information of instruments. Compared with traditional anatomical teaching methods, they can study even at home, they also can use virtual experiments to conduct "self-service experiments" for inquiry learning, so as to gain knowledge and exercise experimental ability.

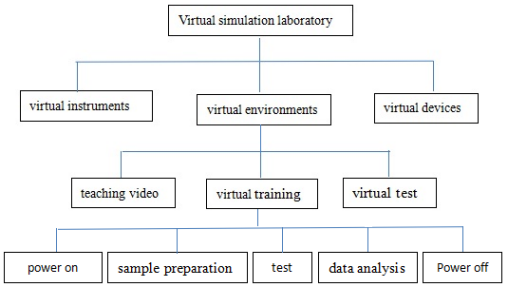

Fig. 1. The structure of virtual simulation experiment system.

3 Construction mode

3.1 Technology

In this system, Unity 3D was used as a development platform for virtual simulation system, and solidworks was used to perform 3D modeling of experimental equipment. The whole virtual system was designed and built by C # script language programming and UGUI interface design tools. Beside, flash was used in virtual training module.

3.2 Multimedia teaching

Instrument teaching course has practical and applied nature, and its content is abstract. Multimedia teaching could better display by video, animation, color and voice to show the course visibly and vividly. Demonstration teaching plays a particularly important role in experiment teaching, but some students can't follow the teacher due to unable to with a long concentrate. Each teaching video should satisfy demand for the fragmentation of studying. The tenet of the video can give prominence to the keystones and the noduses through which the students can learn in a high efficiency.

3.3 Virtual training module

Based the thought of module design, we part the work as start of the instrument, sample preparation, sample testing, data analysis and shut down the instrument. It is clear for students to define a user interaction step in a process by splitting this functional step into multiple technical steps. According to the effective teaching and task demand, the course is

divided into several task modules. Such many angle, divide into level, teaching mode of module receive better teaching result in practice.

3.4 Virtual test

A virtual test was built as experiment skills of detection method in a virtual lab. After the test, the system will automatically generate a test level report, showing the number of correct answers and scores of the testers, which can help users understand their current levels, and carry out targeted training next. lace the figure as close as possible after the point where it is first referenced in the text.

4 Conclusions

How to enable students to master the complex instruments structure, and how to combine experimental principle and the instrument operations, has always been a difficult problem in experiment education. The current form of education is the traditional group learning mode and the complex, boring, and boring courses can hardly arouse students' enthusiasm for learning. The virtual laboratory can effectively solve the shortcomings of the traditional experiments. This paper analyzes the teaching objective and requirements and then proposes the ideas and principles of constructing the virtual training laboratory training system. It also makes a detailed introduction of technologies and methods of developing virtual laboratories. The virtual simulation technology allows students to observe more clearly and stereoscopically those details that are usually overlooked. Students can observe and operate vivid instruments model from multiple angles, repeated practice, that will undoubtedly increase the students' strong interest in learning. The virtual experiment teaching system has been the important complementation of traditional methods. But it has some disadvantages too as a new teaching method, First, it cannot replace the real experimental environment and operation, if the online and offline activities linked to the activities, there will complement each other. Second, encourage students to construct the virtual platform will help improve students' cognitive ability and practical ability.

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