Research on Virtual Experiment Teaching of Internet of Things

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Citation

Abstract
This paper takes the construction of virtual experiment innovation system as the traction, integrates the modern educational idea, and through the formulation of the relevant standards and norms of virtual experiment, breaks through the common key issues in the construction of virtual experimental teaching environment. Through networking research of virtual experiment teaching, to achieve a breakthrough innovation, the original innovation of virtual experiment on key technology, facing the contradiction between scale and quality of the country's education, overcome the problems of the resources are not balanced, lack of innovation ability.

1. Introduction

Virtual experiment teaching is an important part of the construction of higher education information and experimental teaching demonstration center. It is the product of the deep integration of discipline, specialty and information technology.

Virtual simulation experiment teaching means the teaching function that the real experiment does not have or is difficult to complete. It will provide reliable, safe and economical teaching experiments when it comes to irreversible or irreversible operations, high cost, high consumption, large scale or integrated training.

Aiming at the talent training target and requirement of the Internet of things, the core courses of the Internet of things must have the requirement of synchronous experiment [1-3]. However, the experimental courses in most universities are too prone to the introduction of experimental principles, such as the analysis of measuring circuits and the theoretical analysis of sensors. In the face of things in this emerging discipline, school to carry out the experiment mostly adopts the material form to the experimental teaching, the students can have a deeper understanding of the perceptual experiment, but also has the following problems to be resolved:

a) labs are expensive to build

The traditional experiment teaching mainly depends on the experimental equipment is costly, there is a large initial investment, high cost of maintenance, update, carry out the process by time and place, the manpower, financial constraints and other issues, the experimental teaching cannot be effectively carried out, seriously affecting the quality of teaching.

b) disciplines develop rapidly and equipment is eliminated quickly

The rapid development of the Internet of things, and buy equipment may soon be eliminated, some instruments may within one or two years is no longer applicable, resulting in experiment teaching content cannot keep up with new knowledge and new technology, can let students understand advanced knowledge and technology.

c) experiment teaching has a single form and backward teaching methods
The experimental teaching depends on the theory teaching, and the verification experiment and the isolated unit operation experiment are many, the design, the synthesis and the innovation experiment are few. Many hardware devices can simply show the experimental results, if the students just passively use them, it is difficult to fully understand the detailed changes of each component, can improve the abilities of students and truly understand the whole experiment process, greatly inhibited the students' creative thinking [4], the creative ability of students is not training, not the development of personality.

In view of the above problems, according to the idea of creative education and the requirement of cultivating creative talents, this paper puts forward the construction of virtual laboratory with the idea of modern education. Specifically, the virtual experiment is through the development of relevant standards and norms, to break the common key technologies in the construction of virtual experiment teaching environment, to the construction of virtual experimental teaching resources and the application of the model to achieve a breakthrough innovation, the original innovation on the key technology of virtual experiment on purpose [5-8]. The biggest advantage of virtual laboratory is overcoming the problems of current experimental resources is not enough, lack of innovation ability, but also can effectively improve the quality of personnel training, to provide the core technology for the professional in the field of development support.

2. Theoretical Bases

2.1. Virtual Technology

Virtualization is the transformation of physical resources into logical manageable resources to break the barriers between physical structures. The future, all resources are transparent to the virtual world run in various kinds of physical platforms, resource management will be carried out according to the logic, fully automated resource allocation, and virtualization technology is to achieve the ideal tool for it.

2.2. Internet of Things

IOT refers to the use of local network or Internet communication technologies such as sensors, controllers, machines, personnel and other objects in a new way linked together to form connecting people and things, information technology, remote control and intelligent network management.

2.3. Virtual Experiment Teaching of Internet of Things

It is the guiding ideology of "scientific planning, sharing of resources, focus, improve efficiency and sustainable development", in order to improve college students' innovative spirit and practical ability for the purpose, to share the resources of high quality experimental teaching as the core, with the construction of information experimental teaching resources as the focus, continue to promote the construction of experimental teaching, promote teaching reform and innovation.

2.4. Cognitive Theory

Cognitive learning theory is the basic explanation for learning: learning is a process of internal development, is a kind of assimilation and accommodation do occur alternately, leading to physiological, psychological balance from the state to the unbalanced state of the process cycle. Correspondingly, the cognitive concept of teaching is a specific cognitive processing of itself and the special process for students, so as to promote the development of students' cognitive process in the formation of the students' cognitive structure.

The combination of virtual reality and education should start from the cognitive psychology of students, students focus on the specific experience and understanding on the situation, the assimilation between old and new knowledge learning smoothly, construct their own cognitive structure and promote cognitive development.

2.5. Construction Theory

Constructivism holds that knowledge is not taught by teachers, but the learner in a certain situation that social and cultural background, with the help of other people (including teachers and learning partners), the use of necessary learning materials, through the construction of meaning, because learning is in a situation that social and cultural background, with the help of other people help is achieved through interpersonal activities in the meaning construction process of the constructivist learning theory is that "situation", "cooperation", "conversation" and "meaning construction" is the learning environment of the four major elements or four properties, characteristics of virtual reality technology is conducive to fully reflect the four the characteristics, which can effectively create constructivist learning environment, learners can explore and autonomous learning in which to stimulate the enthusiasm of students To help students construct the meaning of what they have learned. Facts have proved that virtual reality technology effectively creates a constructivist learning environment.

Constructivism provides the best theoretical basis for developing the application of virtual experiment in education. Constructivism holds that the construction of knowledge comes from personal experience. The immersive nature of virtual experiments removes the boundaries between participants and computers, creating an experience for individuals to understand the world and contributing to material learning. Virtual experiments create environments for students to learn non symbolic systems, thus avoiding the failure of students to learn to build on symbolic systems.
3. Literature Review

Currently, researchers have realized virtual experiment teaching from different levels [9-10].

3.1. MBL Chemistry Laboratory at Indiana University

They do some things by computer, such as collecting and analyzing experimental data by computer, displaying experiments by computer, and publishing relevant experiment instruction materials on the internet.

3.2. Digital Organic Chemistry Laboratory, University of Illinois, Chicago

They make full use of cyber source, the Internet provides a series of experimental teaching guide: online experimental teaching materials; teaching schedule; experimental evaluation method, form, time; virtual experiment; teaching links.

3.3. Learn Anytime Anywhere Physics (LAAP) at Carolina State University

They are built to explore the virtual physics laboratory based on Web using Java technology, consists of the following modules: virtual experimental equipments and facilities of Java based on Applet; experimental course module; experimental study result evaluation module; collaborative learning module.

3.4. Open Virtual Experiment Teaching System at Beijing University of Posts and Telecommunications

They use Java Applet technology, B/S structure, J2EE framework, to solve the increasingly tense teaching experiment facilities and field experiment, the elite force organized by Institute of educational technology Beijing University of Posts and Telecommunications network, after years of research, developed a matching can be carried out in the campus network virtual experiment system.

Through the domestic and foreign experimental system, it is not difficult to find: equipment function more rich, the advantages of virtual laboratory at present, but there are also software product price is too high; the technical difficulty is not suitable for students, more suitable for engineers to use; there are a lot of foreign mature experimental products do not support Web network operation. Can only be installed on the local computer to run independently; no teaching management and supporting knowledge aided learning and other issues.

With the development of teaching reform, further information, virtual experiment construction of humanity, to carry out experimental work in colleges and universities has become more arduous and complicated, there is an urgent need for the use of computer information technology to effectively complement the traditional experimental teaching.

4. Research Meaning

4.1. Reduces Equipment Consumption and Saves Experimental Funds

At present, the network of professional networking experimental equipment is not enough, coupled with the daily teaching due to improper use of equipment caused by students, network equipment replacement faster and so on. Can be carried out simulation experiments on the network, and then get the best solution in the experiment, on the other hand, for some complex experimental projects or the projects with a certain danger, the simulation is completed, not only reduces the components of the loss, but also reduce the damage rate of the electronic instrument.

4.2. Promotes the Cultivation of Students’ Innovative Consciousness and Creative Ability

The virtual experiment teaching and the modernization of the means of realization provide favorable conditions for students to carry out innovative activities. Students can carry out comprehensive experiments and innovative experiments under the network environment. They can get rid of the monotonous and monotonous constraints of the original experimental conditions and explore in a deeper and wider field of knowledge.

4.3. Perfects Network Education Technology

Experimental teaching is an important part of knowledge in the network education, virtual experiment teaching is a great promotion to the development of network education in depth, can greatly facilitate students’ self-learning and self-examination, improve the level of laboratory management. At the same time, the workload of teachers is greatly reduced.

In summary, this paper aiming at the virtual experiment teaching present situation, deeply research the method of virtual experiment teaching [11], and give full play to the traditional experimental teaching and computer information technology, and their advantages are complementary, constantly put the virtual experimental teaching to a new level.

5. Research Methodology

First of all, research and development of virtual experiment development standards, the evaluation of virtual experiments, guidance, management and cross platform specification of basic software. According to the development present situation of virtual experiment teaching, develop the standard unified supporting platform based on virtual experiment, virtual experiment evaluation, guidance, management and basic cross platform software specification, implementation platform and resources sharing and can be extended by the combination of a variety of standards and norms, to solve the distributed collaborative work in experimental teaching with the problems existing in the teaching system. With the development of standards and specifications, virtual
laboratory modules and experimental components developed by different laboratories can work together to improve their sharing and reusability. Through the formulation of virtual experiment components, platform flow, evaluation, test and management standards and specifications, it provides the basis and guarantee for the establishment of a unified virtual experimental teaching environment.

Then, according to the virtual experimental teaching environment and the needs and characteristics of the typical demonstration, common key technology research of virtual experiment teaching of visual design, research and development of virtual experimental teaching visualization design of supporting software tools for building virtual experiment teaching environment and typical demonstration and provide technical support and service. According to the common key problem teaching visualization design of virtual experiment, virtual experiment of geometric modeling, image element virtual experiment components modeling, virtual experiment components constraint model, virtual experiment entity construction and visualization, virtual experiment, virtual experiment model of cooperative sensing object reference and virtual experiment teaching scene interaction model, the key technologies for the construction and visualization of the common development. To design the virtual experiment teaching visualization, software and integrated environment should be utilized.

Finally, according to the requirements of virtual experiment teaching and management, the paper studies the intelligent instruction of virtual experiment process and the key technology of automatic correction of experiment results, so as to provide all-round auxiliary functions of Virtual Experiment Teaching.

Specific research methods are:

1) for the multi domain modeling problem of virtual experiment components, using the method of quasi unified modeling of Multidisciplinary Virtual Experiment components, unified mathematical expression mechanism consistent expression mechanism, including a variety of physical properties of virtual component logic, and hierarchical relationship expression method.

2) for the assembly of the connection of virtual experiment components, using the method of quasi multidisciplinary virtual experimental component connection and assembly technology, the mechanism of the expression of connection method, including the expression of virtual experimental component interface, and realize the virtual experimental component assembly technology etc.

3) for the analysis mapping problem of the virtual experiment model, some models can be adopted, such as the fast compiling technique of the model, the mapping technique of the hierarchical structure model to the flat mathematical model, and so on.

4) to solve the problem of reduction of virtual experiment model, the model for solving the planning decomposition, serialization model reduction, discrete event processing and event iteration, and continuous discrete hybrid model solving technique.

6. Conclusions

This project aims at solving the shortage of traditional experimental teaching and improving the ability training of students. Aiming at the problems that need to be solved urgently in the construction of virtual experimental teaching environment of Internet of things, the following three sub topics should be set up: 1) research on the development, evaluation and management of virtual experiment. 2) research on key techniques of visual design of Virtual Experiment Teaching. 3) research on intelligent guidance of virtual experiment. Among them, the first one provides the basis and guarantee for establishing a unified virtual experimental teaching environment through the formulation of standards and specifications such as virtual experiment component, platform flow, evaluation, test and management. The second one provides tools and middleware for the development of virtual experiment, focusing on the visual design of virtual experiment. The third one provides the evaluation, testing, guidance and management functions of virtual experiments.

References


