

# The Application of the Virtual Experiment in Physics Teaching

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**Abstract.** In this paper, the main research object is the physical experiment teaching, through a large number of literature, found many problems in physics experiment teaching at present, mainly related to the experiment content, experiment equipment and experimental teaching methods problems such as improper. As information technology and curriculum integration of thought is deeply rooted in the hearts of the people, physics teaching in order to improve the teaching efficiency, gradually integrate with many teaching education software, such as simulation physics laboratory, such as geometric sketchpad and flash applications. By using virtual experiment teaching platform, teaching software and virtual experiment, can have a good teaching effect. For the virtual experiment in physics experiment teaching better application provides the feasibility. Therefore, the focus of this study is the virtual experiment in the junior middle school physics experiment teaching application.

## Introduction

Physics is a based on the experiment of the discipline, the concepts, principles and laws of physics are concluded through scientific experiments. During the experiment, students can experience the process of exploring truth, scientists to explore the scientific difficulty and beauty, master the scientific experimental research methods, to cultivate their exploring ability and scientific mode of thinking, formed a strong problem solving ability. With the rapid development of science and technology, information technology application in education, the application of the virtual experiment is one of the main product information technology into physics experiment teaching [1]. Virtual experiment can solve the difficulties in the current experimental teaching can increase the rate of the experiment of open, focusing on the penetration of experimental method, and the experiment content and experiment equipment is improved. The experimental method has great advantage, can simulate most of the physical experiment content, to make up for many deficiencies of traditional experiment teaching [2]. First of all, it can provide many experiments with virtual experiment platform, and save time than real experiment, can improve the physics experiment open rate, and many equipment complex designs open experiment open rate can be greatly improved. Second, it alleviate the problem of insufficient of the current part of the school physical experiment equipment, especially in rural and township areas; Third, it can make improvements of experimental content, can according to the practical ability of students, will be even more enrich experiment contents and rich, not just confined to textbooks, let physical really toward life, you can also add some design and open experiment, cultivate students' ability of scientific inquiry; Fourth, can with the help of virtual experimental system, experimental methods to better penetration, cultivating students' ability to use scientific experimental methods to solve practical problems. Therefore, to the introduction of the virtual experiment of physics experiment teaching is a real need.

## The process of virtual experiment

The essence of virtual reality technology is through the computer interface to the user to provide more intuitive visual, auditory, etc., the perception of the nature interaction experience. Its purpose is to a greater extent of provide users with better and more intimate services, reduce the burden,

improve the efficiency of the operation of the system. Virtual reality technology is to use the computer connection provide users with a variety of sensing equipment and the environment of natural communication and communication technology, it is more of a simulation to the realistic environment. And environment simulation is the use of all kinds of 3D computer generated graphics, provide users with visual, hearing, touch more vivid, immersive experience, can be a simulation of reality, can also be a pure idea [3-4].

Ways and operation process of virtual experiment and real experiment process is very similar, i.e., using the mouse or the keyboard click. In a virtual laboratory to test bench, according to the experiment content with the mouse click and drag the virtual components such as operating mode to complete the experiment process, get the results of the experiment, finally summarizes the experiment, so as to achieve consistent with the real basic effect. A complete virtual experiment process is shown in figure 1.

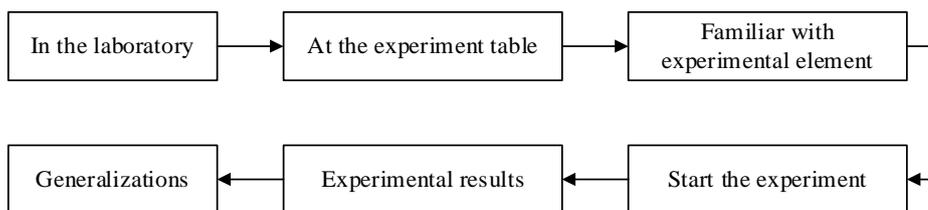


Figure 1. The process of virtual experiment

### The content design of the virtual experiment system

According to the outline of physics teaching and physics knowledge classification management thought, will be divided into physics mechanics, thermo logy, acoustics, electricity, lighting the five knowledge system. In accordance with the principle of modular design, the virtual experiment system in content structure, general middle school physics experiment is divided into five experimental modules, namely: the mechanics laboratory, thermal laboratory, acoustic laboratory, electrical laboratory, optical lab [5]. Each lab module (module, for example) by electrical laboratory basic covered all electrical experimental physics course, and for each concrete experiment (ohm's law, for example) on the content design adopts the experimental model of teaching outline, namely the main content is: the experiment purpose, experimental principle, experimental equipment, experimental help, began to experiment, experiment analysis, as shown in figure 2.

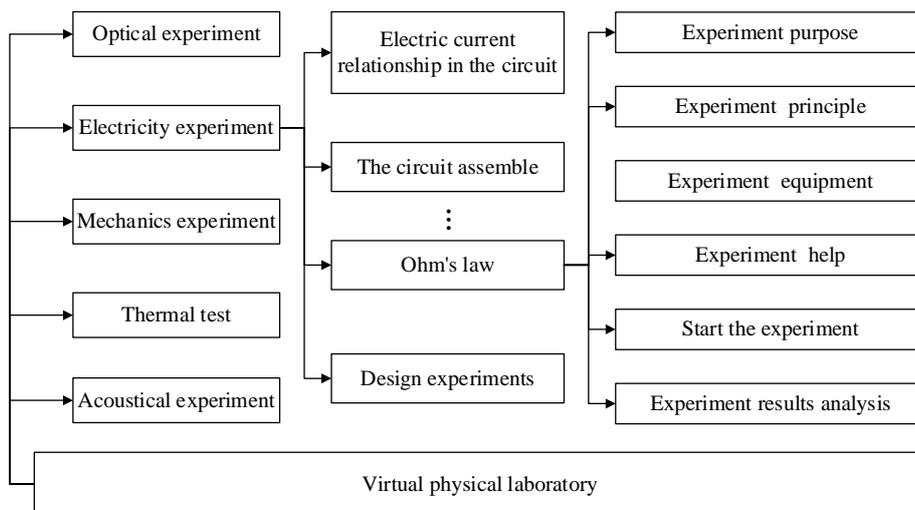


Figure 2. The content of the virtual experiment system

On design style, the system for each lab module USES a unified interface style, for experiment module under each specific experiment, also USES a unified style of interface design. Now electrical module of ohm's law laboratory experiment, for example, for each specific experimental design in detail. Experimental purpose module in detail the purpose of this experiment, make

learners to clear the requirement of the experiment. Principle of experiment module shows that this experimental principle, targeted to make learners in the experimental process of experiment operation. Experimental equipment modules of equipment required to complete the experiment. The help module includes two aspects of content. One is the content of virtual experiment, operation steps, and experiment related knowledge; On the other hand is the operation help information relating to the virtual experiment system itself. Start experiment module is mainly to the learners to complete and provide a virtual experiment environment, need to join the scene factor, on the basis of maintaining the characteristics of the learners' degree of freedom and high interaction. The module completely simulation operation, process, phenomenon, reflects the nature of the experiment.

### The application of virtual experiment system in physics teaching

Development of virtual experiment system is in order to make learners in a real experiment before using this system effectively prepare, help learners based on the perceptual knowledge, help learners to overcome the reality in the experiment of wrong operation and blind operation, to shorten the time of the real experiment. Can make learners learning is difficult, operation steps of the experiment, through the virtual experiment of the preparation, understand the experiment each step play a role in the process of experiment, to help learners to understand the experimental principle, digestion experiment content, give full play to the virtual experiment system in a real experiment before and after the auxiliary function. Due to open application of the virtual experiment, will break the traditional experimental teaching process, therefore teaching to be adapted to virtual experiment teaching mode is very necessary.

The simulations in the virtual lab reproduce experiments that can be performed in actual school lab settings. 2-D depictions of the experimental set-up are displayed in the simulation window, as shown in figure 3. For each experiment, the user is presented with the appropriate view of the set-up, with a line of sight either along a vertical axis or a horizontal one.

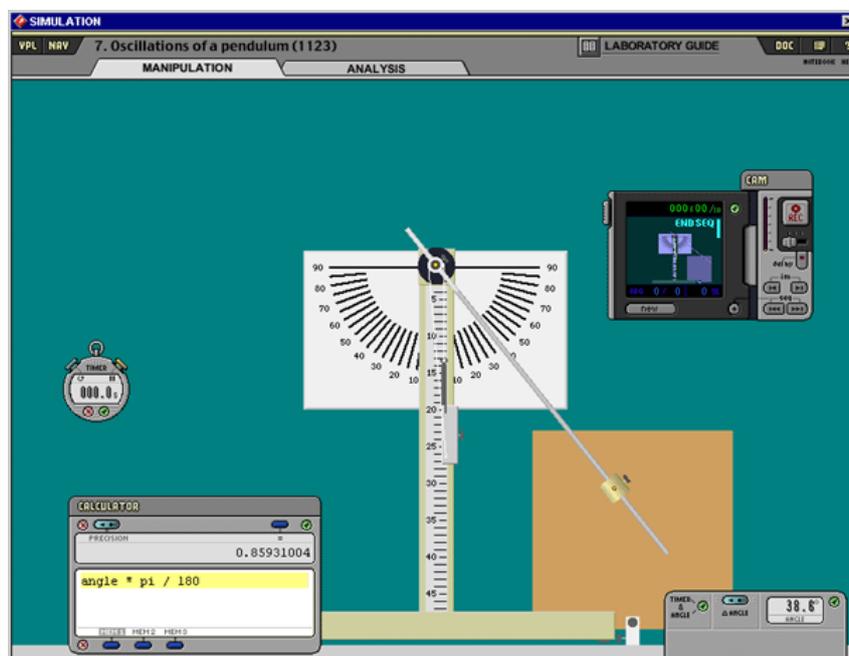


Figure 3 The physical pendulum experiment based on virtual system

As in an actual lab, the learner can act upon the simulated set-up by changing its configuration and by moving its components. This can be done either by clicking and dragging the objects in the set-up or the moveable parts of the apparatus, or else by clicking buttons on remote controllers located at the lower edge of the window.

All the simulations contain a cue indicating the actual size of depicted objects. It can either be a ruler, an object of known dimensions, or a written indication of size. This cue allows the student to determine the scale factor needed to express distance measurements in appropriate units.

The virtual lab has been designed to accommodate a dozen or so mechanics experiments covering the main topics of this subject matter. Three have been included in the prototype: one deals with a physical pendulum; the other two are experiments performed in a rotating merry-go-round, one of them on an air table placed inside the latter.

One should mention that these particular experiments were not chosen to be part of the prototype for pedagogical reasons, but rather because of the availability to the designers of related existing video content of the apparatus required to produce our own video clips. In fact, these experiments, which are in the middle of the list in the navigation space, are not simple enough for most novice experimenters.

## **Conclusion**

With the rapid development of science and technology, information technology application in education, the application of the virtual experiment is one of the main product information technology into physics experiment teaching. Virtual experiment can solve the difficulties in the current experimental teaching can increase the rate of the experiment of open, focusing on the penetration of experimental method, and the experiment content and experiment equipment is improved. Virtual experiment as following the theoretical research and experimental research methods, the social development and plays an increasingly important role in the progress of science and technology, represents the development direction of scientific research methods. Of the development of virtual experiment at home and abroad has been introduced in this paper, the theoretical foundation of the virtual experiment is analyzed, and the use of technology, in detail elaborated the virtual experiment system, the whole process from design to implementation and choose the typical physics experiments as objects of application and study of virtual experiment, focusing on the application of the virtual experiment in physics teaching has made the thorough analysis and research.

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Research of subject teaching in ideological and moral education.

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