

# Research on Virtual Simulation Experiment Teaching Mode of Civil Engineering Specialty Oriented to Independent Learning

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**Abstract.** By means of simulation theory and deep research in the theory of civil engineering specialty, careful analysis of the current civil engineering professional course teaching features and common problems in teaching, analysis the application of virtual simulation technology in civil engineering experiment teaching, put forward three kinds of autonomous learning civil engineering professional oriented virtual simulation experiment teaching mode.

## Introduction

Teaching mode is under the guidance of certain educational ideology, teaching theory and learning theory, in a certain teaching environment and teaching. With the support of resources, there is a stable relationship between various elements in teaching and learning activities and a structural form of activity process [1]. "Teaching mode refers to the stable structure of teaching activities under the guidance of certain educational thoughts, teaching theories and learning theories [2]. The traditional teaching mode is limited to the development of learners' low-order ability and thinking, and it supports the low-order learning. Simulation under the technical support of simulation teaching model tries to break through the limit, through effective learning environment design, promote learners in innovation, problem solving, decision making, critical thinking, information literacy, teamwork, compatible, capture tacit knowledge, self management and sustainable development ability of higher-order ability can get effective development [3].

As a new development of teaching mode in the information age, simulation teaching mode is based on virtual simulation technology [4]. The so-called simulation teaching mode refers to the teaching activity structure and teaching mode supported by simulation technology, including relevant teaching strategies and methods [5]. From the perspective of consciously adapting to the needs of The Times and personal development, the purpose of virtual simulation teaching mode is to promote learners to develop the knowledge, ability and quality required by The Times by changing the learning mode. The simulation teaching mode based on simulation technology has both a sense of strangeness and a sense of curiosity for students. For teachers, the implementation of simulation theory of simulation teaching, but also lack of theoretical understanding and practical experience, how through the course based on simulation technology, so that students can not only grasp the current simulation teaching understanding, but also can harvest in practice, is the study of this new teaching model of thinking.

## Problems Existing in Practice Teaching

With the undergraduate teaching evaluation of the ministry of education and the deepening of education and teaching reform, the reform of experimental teaching has made some progress.

First, the experiment arrangement is not reasonable, the experiment becomes a form. In the traditional experimental teaching mode, students are assigned to do experiments in groups according to the experimental topics and class time arranged by the teacher in advance. In class, the instructor first explains the demonstration, and then students operate, observe and record the data according to the experimental handout. This teaching model has played a good teaching effect, but there are also some disadvantages [6]. During the whole experiment, middle school students are in a passive position. When doing the experiment, students operate the machinery according to the steps in the handout, without their own innovation [7]. To some extent, it restricts students' initiative and creative

play, which is not conducive to cultivating students' ability to analyze and solve problems [8]. The experiment teaching content is out of date, the experiment form is invariable, cannot stimulate the student's experiment enthusiasm. Moreover, experimental projects cannot be well matched with classroom teaching progress, and the number of experimental teachers is in short supply. The opening time of the laboratory is only at specific experimental time, so it is difficult to open the laboratory to students at any time.

Second, most experimental projects are confirmatory and lack of design and comprehensive experimental projects. Most of the experiment content is not deep and wide enough. The experiment set is mainly to verify the theories in books, and the experiment items are some verifications. What the students are provided with is only a single experiment to read some data. Most experimental textbooks or manuals already list the specific steps students follow in the lab. In this way, the experiment makes students explore less and cannot explore and analyze more deeply. The experimental course lacks design class and comprehensive experiment. It is difficult to develop students' innovative thinking and practical ability, unable to combine theory with practice, let alone master the latest technology.

Third, it is difficult to support the research experimental teaching due to the insufficient investment of experimental funds. Due to the relatively insufficient capital investment in the construction of laboratory hardware and the long maintenance period, the laboratory management staff are afraid to let students use it freely. There are too many students in class, the number and types of laboratory instruments are insufficient, and the update rate of instruments and equipment is low. At present, in the traditional experimental teaching of civil engineering, there are many single experiments with a wide range of contents and time constraints. In the whole experimental process, students often copy the lecture notes without taking the initiative to study and study experimental principles and methods, resulting in the lack of application and innovation ability. The characteristics of civil engineering major determine that the experiment is a high-consumption experiment. In addition, due to the high cost of some experimental equipment, especially some advanced equipment and instruments and components, it is difficult for many schools to purchase due to insufficient funds, or the experimental equipment purchased is far from enough. At the same time, because the experiment of civil engineering is dangerous, the experimental process students have no protective measures, so that the safety of the equipment and personnel, and the necessary experimental project in the experiment is left out, which causes the un integrity of the experiment content.

## **Teaching Mode**

### **Imitation of Real Teaching Mode**

Simulation + practice teaching mode is a teaching mode with problem solving as the development line. It is a teaching mode under the guidance of teaching objectives, starting with the discovery and presentation of problems, and focusing on the analysis and solution of problems and the generation of new problems. It emphasizes that students complete their learning in the process of solving practical problems, and students conduct self-conscious evaluation and reflection through independent exploration and cooperative learning in the learning process. Before the experiment, students first simulate the content of the practical operation experiment from personal computer or school network room with simulation software, preview the experiment in a "real" environment, analyze and solve the whole experiment in the process of simulation preview, and then go to the physical experiment table to operate the experiment. Compare the data obtained from the real experiment with the data obtained from the simulation experiment. If there is a big discrepancy or error between the actual result and the theoretical analysis operation, students will carry out the simulation deduction on the simulation computer provided by the laboratory at any time, so as to guide the practical operation. This new problem found in the cycle, through the simulation and deduction -- practical operation -- problem discovery -- simulation again simulation cycle process, using the advantages of the simulation environment, simulation of real experimental external conditions and internal reasons, to

conduct independent exploration. In the exploration to find out the problem, solve the problem, take the initiative to reveal the inner connection of knowledge, explore the process of knowledge, so as to learn to think, learn to explore and seek knowledge, learn to cognitive processing, learn to self-monitoring, so as to achieve the effect of learning.

### **Fault Analysis Teaching Mode**

In the traditional experiment, failure setting is often the forbidden zone of the experiment, which is easy to cause equipment damage or personnel safety accidents. This model allows students to experience the process of knowledge generation as scientists discover. Failure setting and solving can improve students' curiosity in knowledge, increase their intellectual potential, stimulate students' inner motivation, arouse their interest in knowledge and acquire problem-solving skills. It is very easy to set up the fault in the virtual simulation test, which is not as time-consuming and difficult to master as the actual fault setting. In the simulation environment, the artificial setting of the experimental parameters will not cause the damage of the equipment and the safety accident of the operator.

### **Self-study Instruction Teaching Mode**

Self-study + instruction mode refers to a kind of teaching guiding ideology in which teachers, according to the objective laws of teaching tasks and learning, proceed from the actual conditions of students, adopt various ways, take inspiring students' thinking as the core, mobilize students' learning initiative and enthusiasm, and encourage them to take the initiative to learn. Self-study + instruction mode is an independent learning mode under the guidance of teachers. This teaching mode can cultivate students' independent thinking ability. Through the process of self-study, discussion, inspiration, summary and practice consolidation, teachers assign some learning tasks related to the new teaching content to organize students to study by themselves according to the recent development area of students. After self-study through simulation software, students are allowed to communicate and discuss with each other to find out the difficulties they encounter. Then teachers point and inspire students according to these situations, summarize the rules, and then organize students to practice and consolidate. In order to cultivate students' learning ability, we should give full play to students' subjectivity in the teaching process.

### **Conclusion**

With the rapid development of simulation technology, virtual simulation teaching has become a hot topic in education research, and it is urgent to study new teaching mode. From the relationship between simulation technology and civil engineering professional experiment teaching, the way of exploring the method of virtual simulation experiment teaching and the way of teaching reform, build the new experimental teaching model based on simulation technology, improve the efficiency of learning, and promote the construction of the knowledge of learners. It provides new methods and approaches for current experimental teaching, and provides theoretical guidance for teaching reform, so as to improve the effectiveness of experimental teaching of civil engineering specialty and promote the application of modern educational technology in teaching and research of civil engineering specialty.

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