

# Research and Practice on the Practical Teaching Construction of Virtual Simulation in Electrical Specialty

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**Abstract:** Based on the current situation of practical teaching in the field of electrical specialty, integrating the teacher team, building the curriculum chain, and closely following the three dimensions of "knowledge", "ability", and "quality", virtual simulation practical teaching is offered to break the teaching bottleneck of difficult to complete physical experiments and improve the quality of practical teaching in electrical specialty.

**Keywords:** Virtual Simulation; Practical Teaching; Electrical Specialty.

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## 1. Introduction

In 2019, the "Implementation Opinions of the Ministry of Education on the Construction of First Class Undergraduate Courses" included the national virtual simulation experimental teaching project in the construction of first-class undergraduate courses. In 2023, the Ministry of Education announced the second batch of national first-class undergraduate courses, and identified 472 first-class courses in virtual simulation experimental teaching [1-2]. The innovative teaching mode of virtual simulation has become a new highlight in the field of education and has been fully recognized and praised.

The electrical major involves various aspects of power generation, transmission, distribution, and consumption in the power industry. The existing electrical engineering experiments and practical teaching cannot meet the requirements of electrical engineering talent cultivation, which has become a serious problem faced by the training of electrical professionals in various universities [3]. Building a virtual simulation practice teaching team, utilizing information technology to construct virtual simulation practice courses, complementing virtual and real experimental teaching, breaking the teaching bottleneck of difficult to complete physical experiments, is of great significance for improving the quality of practical teaching in electrical majors and cultivating students' innovative abilities.

## 2. Purpose of the Research

### 2.1. The Teaching Bottleneck of Difficult to Complete Physical Experiments is Broken

High-quality teaching resources are formed and the teaching bottleneck of difficult to complete real experiments is broken through starting from the particularity of the

electrical profession, utilizing information technology to create a virtual simulation teaching team, constructing virtual simulation experimental teaching resources, and bringing large-scale electrical equipment, engineering, and other projects that cannot or are difficult to complete in real experiments into the laboratory.

### 2.2. Education and Teaching Reform that Integrates the Imparting of Knowledge, the Cultivation of Abilities, and the Formation of Qualities is Done.

The teaching team fully utilizes its creativity, explores the teaching ideas of combining virtual simulation with practical teaching, and conducts exploration and research on the curriculum education concept and practice that integrates knowledge imparting, ability cultivation, and quality formation, strengthening the three dimensions of "knowledge", "ability", and "quality".

## 3. Research Content and Method

### 3.1. Research Content

On the basis of analyzing the current situation of practical teaching in electrical engineering, the goals of virtual simulation practical teaching reform are clarified, and a teacher teaching team is established. A curriculum chain of 16 courses and 7 links of "foundation major comprehensive" is constructed, and a virtual simulation practice project of "knowledge ability quality" is gradually established, which is interrelated and gradually improved. Through teaching evaluation, the teaching content is continuously optimized and the quality of practical teaching is improved. The mainline of research content is formulated, as shown in Figure 1.

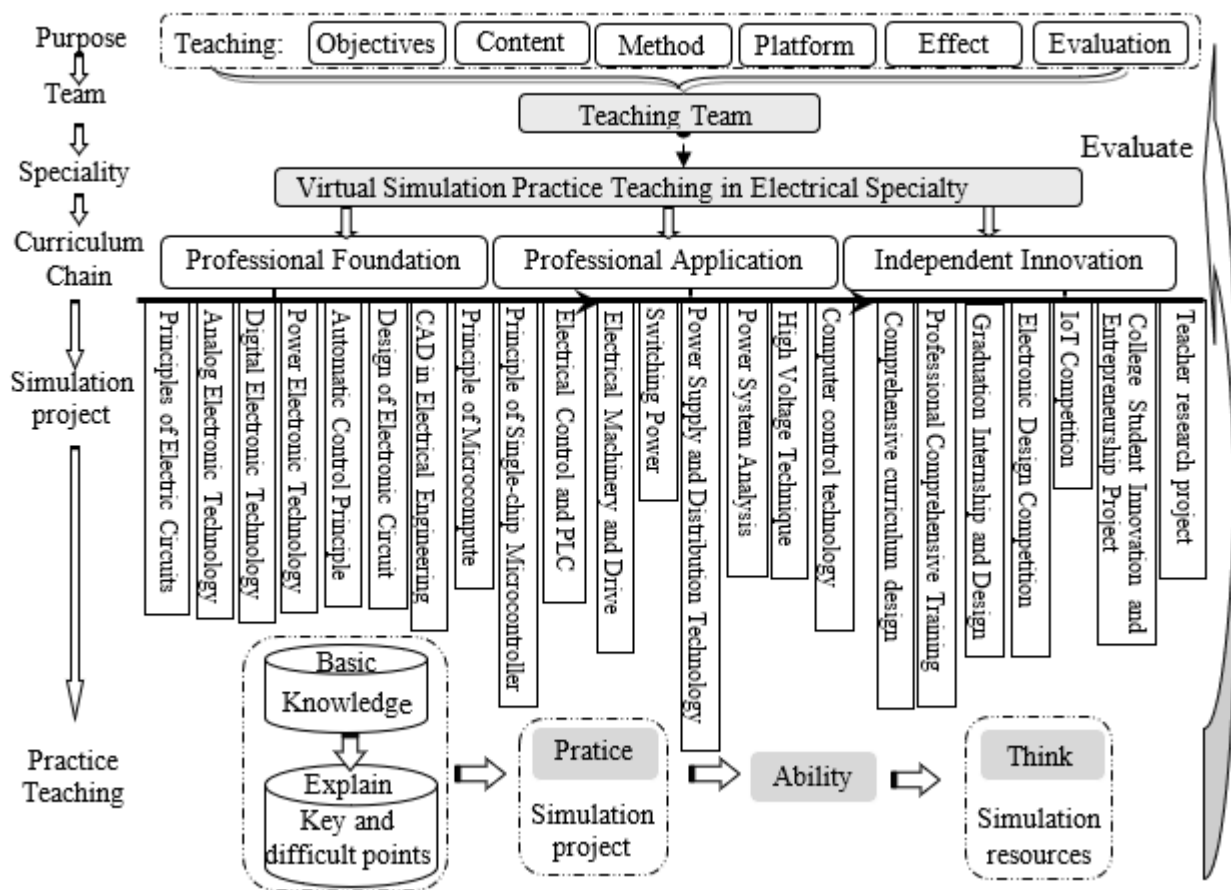


Figure 1. Mainline of Research Content

## 3.2. Research Methods

### 3.2.1. The Objectives of Teaching Reform is Clarified

In this article, the difficulties in practical teaching of electrical engineering and the needs for cultivating students' practical and innovative abilities are analyzed, and the goals of teaching reform are clarified with the combination of the current situation of electrical engineering teaching in our college

### 3.2.2. The Teaching Staff is Integrated and Optimized

The teaching staff through diversified channels of external introduction and internal training is integrated and optimized, and a virtual simulation practical teaching team for the electrical major is built based on the combination of teaching staff transmission, assistance, guidance, and the combination of the elderly, middle-aged, and young.

### 3.2.3. A Systematic Curriculum Chain is established

A systematic course chain of "professional foundation professional application independent innovation" to enable students to have a visual and three-dimensional understanding of the main knowledge points of electrical engineering and the relationships between various courses is established.

### 3.2.4. A Virtual Simulation Practice Project is Constructed

The comprehensive application between courses is achieved through selecting and combining virtual simulation resources, constructing virtual simulation practice projects from multiple perspectives, breaking the boundaries of various courses according to the principle of "combining virtual and real, being able to be real but not virtual, and

complementing each other",

### 3.2.5. Virtual Simulation Practical Teaching is Established

The transformation from knowledge to ability and then to quality is achieved through exploring the teaching approach of combining virtual simulation with practical teaching, integrating experimental teaching resources and offering virtual simulation practical teaching [4].

### 3.2.6. Reform Effectiveness is Evaluated

A teaching reform effectiveness evaluation model that combines internal and external cycles is explored in order to continuously update practical teaching content, improve virtual simulation practice projects, enrich practical teaching in electrical engineering, and enhance the quality of student training.

## 4. Research Plans

### 4.1. A Systematic Course Chain is Established

The new ideas for the development of virtual simulation teaching resources, team building, and the application of teaching are provided through which team members divide their work and cooperate to deeply analyze the interrelationships between knowledge, ability, and quality dimensions, establish a curriculum chain of 16 courses and 7 links in the "Basic Professional Comprehensive" electrical education, starting from the professional training objectives and actual teaching situation on the basis of determining the direction and work ideas of simulation teaching construction, on the basis of determining the direction and work ideas of

simulation teaching construction.

## 4.2. The Virtual Simulation Teaching Resources is Built

The results oriented education model is promoted, following the principle of simulation resource construction, with the mode of which senior teachers lead teams and young and middle-aged teachers are grouped to construct virtual simulation resources based on the principle of "combining virtual and real, being practical but not virtual, and complementing each other". Virtual simulation resources are selected and combined to complete a progressive virtual simulation experiment project of "professional foundation professional application independent innovation" in four stages: preparation stage, construction planning, project design, and project construction, in order to overcome the difficulties of professional practical teaching.

## 4.3. Implementation of Virtual Simulation Teaching

A three-stage teaching model of practice, ability, and thinking into the practical teaching process for different course groups is introduced, and virtual simulation teaching for electrical majors is implemented.

During the teaching process, on the one hand, students are allowed to freely choose groups, summarize and condense experimental ideas and technical routes, propose possible optimization plans, make the knowledge structure three-dimensional, and then track teaching effectiveness by summarizing and assessing students' mastery; On the other hand, teachers constantly reflect on the rationality of virtual simulation project construction, classroom activity level, and actual teaching effectiveness, and continuously improve simulation projects through internal and external circulation mode analysis.

## 5. Implementation Effect

### 5.1. Teaching Forms are Enriched

Through virtual simulation experiments, on the one hand, projects such as large electrical equipment and engineering that cannot or are difficult to complete in real experiments can be brought into the laboratory and transformed into high-quality teaching resources; At the same time, it also makes up for the shortcomings of equipment shortage, outdated equipment, and component loss in traditional experimental teaching, and stimulates students' interest in learning. On the other hand, it breaks free from the limitations of real experiments in terms of time, location, frequency, and number of people, increases students' mobile phone skills, and

improves their innovation and practical abilities.

### 5.2. Demonstration and Leadership

Virtual simulation teaching has been opened to all students in the school, and some virtual simulation experimental projects are also exploring resource sharing in enterprises. Years of teaching practice have proven that this virtual simulation experiment course model has significant effects and is deeply loved by students. The virtual simulation experiment teaching mode has also cooperated and exchanged with brother universities, effectively demonstrating, leading, and radiating its role.

## 6. Summary

Virtual simulation technology has become very mature, and its application in teaching has been widely recognized both domestically and internationally. However, with the rapid development of information technology today, the demand for college graduates to proficiently apply new knowledge in modern society is increasing. In order to meet the demand for application-oriented talents in the new era, we need to deepen the deep integration of modern information technology and education teaching in future teaching, and achieve the virtual real complementarity between virtual simulation experiments and physical experimental teaching.

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