

## Reform of Experimental Teaching Under the Background of New Engineering

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**Abstract:** Based on the research of experimental teaching innovation under the background of "new engineering", this paper first analyzes the current situation of Higher Engineering Education in China, then discusses the existing problems in the current experimental teaching mode of engineering colleges, and on this basis, puts forward the introduction of virtual experimental technology into experimental teaching to improve the quality of experimental teaching. Using the advantages of vivid virtual reality technology can significantly improve the practical teaching effect, and can better adapt to the needs of talent training in the background of new engineering, so as to enhance the overall innovation level of Engineering Science and technology talents in China.

### 1. Introduction

At this stage, our society is in a special stage of scientific and technological revolution and industrial upgrading and transformation, especially after the "new engineering construction" is proposed, the teaching mode of Engineering Colleges and universities ushered in more opportunities and challenges [1-2]. Since 2017, new engineering construction has rapidly spread in the field of engineering education around the Fudan consensus, Tianda action and Beijing Guide "trilogy", opening up a new direction of engineering education reform. The construction of new engineering has triggered a new round of reform upsurge of Engineering Education in Colleges and universities across the country, and has become a hot issue in the field of the whole society and higher education [3-5]. "New engineering" emphasizes the practicability, intersection, comprehensiveness and innovation of disciplines, and focuses on training a large number of diversified and innovative outstanding engineering science and technology talents. Under this requirement, the curriculum and teaching of specific majors should also focus on practicality, intersection, comprehensiveness and innovation.

Compared with the traditional engineering talents, the society will need more compound "new engineering" talents with strong practical innovation ability and international competitiveness in the future, and the compound "new engineering" talents have more "interdisciplinary" characteristics, which will play a leading role in future science and technology and industry. The current new requirements for talents provide opportunities for the construction of "new engineering", and social development and progress need the construction of "new engineering" [7-8]. Under the background of "new engineering", the training of engineering talents needs the combination of theory and experiment. When learning the theoretical knowledge, the experimental experience of students is gradually paid attention to. Experiment teaching is beneficial to the development of students' innovative thinking, which highlights the importance of experiment to engineering students. Therefore, it is of great significance to study the experimental teaching of Higher Engineering Education under the background of new engineering.

## **2. Analysis of Current Situation of Higher Engineering Education**

At present, nearly a thousand colleges and universities in China have set up engineering majors, and engineering students account for about 35% of the total number of Chinese college students, which reflects that China's social and economic development has a great demand for engineering and scientific talents, and also proves the importance of training engineering and scientific talents in the era of knowledge economy. However, the quality of engineering personnel training in China is quite different from that in developed countries, and its international competitiveness is relatively weak. After graduation, students are unable to adapt to work due to the disconnection between learning and using, and the poor effect of experimental teaching is one of the main reasons for this problem.

Traditional educational concept regards experimental teaching as theoretical teaching. In fact, experimental teaching is a supplement and development mode of theoretical teaching, an important means for students to consolidate knowledge, and a component of school teaching. Therefore, how to construct efficient experimental teaching mode is the key subject of reform research. At the present stage, the higher engineering education in China still adopts the teaching mode of learning basic theory in the first and second years, learning major in the third year, and learning professional courses in the fourth year. Although the proportion of experimental teaching hours has increased in recent years, the experimental teaching effect is still not optimistic enough.

## **3. Analysis of Problems Existing in Experimental Teaching Mode of Engineering Colleges**

In recent years, China has paid more attention to the reform of higher education, constantly updated the higher education system and teaching model, and achieved certain results. However, although the current experimental teaching model is constantly improving, there are still deficiencies, mainly in the following aspects:

### **3.1 Importance of Experimental Teaching is Ignored**

For a long time, the mode of talent teaching and training in our country focuses on theoretical teaching and ignores experimental teaching. Focus on classroom knowledge learning, ignore extracurricular knowledge acquisition; Focus on the depth of knowledge, ignore the breadth of knowledge. Even in the case of the current higher education scale expands unceasingly, and the teachers and students in colleges and universities are not enough attention to experimental teaching, teaching resources in local colleges in China tend to theoretical teaching and ignores the phenomenon still exists of the experimental teaching, experimental teaching mode innovation and development struggle, these and other countries advocates the cultivation of innovative consciousness and pay attention to talent education experiment of the teaching mode has a distinct.

### **3.2 Limited Experimental Teaching Resources**

It is not enough for colleges and universities to train engineering talents who can meet the requirements of the new era only by relying on their own teaching resources. Due to the lack of experimental teaching faculty, some teachers' practical cognition has not been updated and they do not understand the requirements of the society for talents. Although they have abundant theoretical knowledge, they lack practical teaching experience and the experimental teaching content is relatively old. At the same time, there are not many funds available for experimental teaching, the facilities of experimental education base are old, and the allocation of professional personnel is not in place.

### **3.3 No Systematic Practical Teaching Chain between Experimental Teaching and Practical Education**

Practical teaching in colleges and universities is not only experimental teaching, but also practical education. Experimental teaching and practical education constitute the necessary links of

practical teaching. The main purpose of experimental teaching is to verify theoretical knowledge and master practical training skills, while the main purpose of practical education is to cultivate students' innovation ability, teamwork spirit and expression ability. The practical education outside school provides the opportunity for students to enter the front line of enterprise r&d and production, and promotes students to form engineering thinking, engineering practice ability and accumulate engineering experience. In the process of practice, there are usually differences between experimental teaching and school teaching, and the connection and interaction between each other is weak, so there is no systematic chain of practical teaching.

## **4. Experimental Teaching Mode Innovation under New Engineering Background**

### **4.1 Improve Structure and System of Experimental Teaching**

The main purpose of experimental teaching reform in the new engineering background should be to weaken the academic consciousness and return experimental teaching to the nature of engineering service. On the basis of understanding the requirements of engineering experiments, and according to the knowledge of professional courses, we actively create a progressive experimental teaching system. The experiment teaching is divided into basic experiment, design experiment, innovation experiment and real habit experiment. The experiment contents of the four parts are complementary to each other.

- The basic experiment serves the basic professional courses, and the focus of the experiment is to test the principles and methods of the basic courses. Students can master the basic principles of the major through experimental operations, and set this part of the experiment as a compulsory course to increase the proportion of class hours. In addition, teachers also need to invest more time in experimental teaching to help all students master the experimental content quickly.
- Design experiments serve a number of professional courses, which will be offered successively after the junior year. The experimental contents should be expanded on the basis of basic experimental contents based on the knowledge of other professional courses.
- Innovative experiment means that the teacher gives directional guidance to the experiment process, and the students select relevant topics according to their own will, and design the experiment contents independently. At the same time, students can also set up experimental groups by themselves, and do a good job in the relevant division of labor, choose the corresponding experimental facilities, and jointly solve the problems in the experiment. In addition, in order to be open to students with better learning ability, innovative experiments can be further enhanced to offer elective courses for these students. These experiments require students to have stronger hands-on ability and more theoretical knowledge reserve, and experiments need more time. Students can play independently according to the topics set by teachers, and can also design experiment contents by themselves and conduct experiments in the form of teams. Innovative experiments help to give play to students' autonomy, make experimental teaching closer to practical work, and lay a foundation for students to enter social work.

### **4.2 Optimization of Practical Teaching Content**

To optimize the experimental teaching content is to integrate more engineering examples into the teaching content, enhance the experimental teaching effect, and integrate the experimental curriculum system, laboratory resources and experimental teachers. To cultivate college students' innovative spirit and innovative ability combined with specialized courses teaching and experimental teaching, the teaching of specialized course as a starting point, focus on cultivating students' innovative spirit and ability, establish basic, gradation and systemic trinity teaching system, based on the target culture, highlight the new engineering background and proper grasping of the features of The Times development, strengthen mutual confluence, make students explore independently, present academic achievements. The student-centered teaching method is put

forward and implemented. According to the problems, the routine teaching can be realized while personality is cultivated. The multimedia teaching method is adopted to present the experimental teaching process. First, the design from the basic to the comprehensive innovation to such a teaching content system, in view of the students in the experimental teaching in the lack of innovation spirit and practice ability and innovation ability, through the specialized course teaching and course construction, innovating teaching content, highlight new engineering background, the strengthening of comprehensive courses that cross application, create and conform to the teaching system of cultivating creative talents; Second, to solve the problem of students' weak comprehensive application ability, we should create a teaching content system that focuses on problems and highlights practical applications, so as to improve students' ability to solve practical problems. Thirdly, students acquire knowledge mainly by means of indirect acquisition. Therefore, the teaching of specialized courses and experimental teaching must give students the experience of acquiring direct knowledge. Therefore, it is necessary to form a teaching mode focusing on cultivating innovative thinking and improving students' innovation ability, and to lay emphasis on cultivating students' creative thinking.

#### **4.3 Update Experimental Link Assessment and Evaluation System**

The evaluation system of experimental links should be updated to form a student-focused engineering education model, change the traditional evaluation method that focuses on experimental results, and attach more importance to the evaluation of students' experimental operation process, so that students can devote more time and energy to the experiment process. In the stage of cultivating basic ability, it is necessary to attach importance to the understanding and mastery of engineering concepts and practical skills. In the stage of cultivating comprehensive ability, we should attach importance to the assessment of innovative consciousness and comprehensive application ability of knowledge. In the practice of innovation, pay attention to the overall assessment of individual contribution, innovation ability and teamwork ability. The basic training experiment focuses on students' mastery of experimental principles and practical ability. According to the task index of the project, the results of comprehensive design experiment are judged in the form of defense. Research innovative experiments, let the students to draw up the experimental project, and the students to complete the project design and production, finally submit the summary report. In general, adopting diversified assessment methods can innovate traditional assessment methods, which is conducive to enhancing the effect of experimental teaching.

#### **4.4 Implementation of "Excellent Engineer Training Plan"**

Further deepen the reform by carrying out and effectively using the "excellent engineer training plan". The course practice teaching is transformed into two ways of "in class guidance" and "extracurricular autonomy". Through these two ways, students' autonomous learning ability and innovative thinking can be cultivated and improved. The teaching experiment method of combining in class and in class practice projects can be highlighted. The experiment project with virtual simulation reality and related hardware facilities can be designed to improve students' independent design of engineering experiment innovation ability.

The implementation of the "excellent engineer training plan" requires the training mode of professional talents and the joint training mode of talents generated by corresponding industries in Colleges and universities, and guides enterprises to further participate in the training process of talents in Colleges and universities, from the establishment of training objectives, enrichment of teaching content, innovation of teaching methods and other aspects to participate in the training of engineering talents in Colleges and universities. Under the background of new engineering construction, the "independent" can be adopted. The experimental teaching mode of science and engineering specialty is based on the way of setting up courses, the teaching method of heuristic thinking, and the experimental operation of intensive teaching and more practice.

## 5. Conclusion

In a word, under the background of new engineering construction, experimental teaching in higher engineering education is facing more challenges and needs to meet the requirement of students' employment in the future, and also the requirement of China's social and economic development. In order to meet these requirements, the colleges not only need to pay more attention to experimental teaching activities, but also need to explore experimental teaching mode, set up scientific experimental courses, strengthen school-enterprise cooperation and other means to improve students' enthusiasm for learning, enhance the practical effect of experimental teaching, and thus lay a foundation for improving students' comprehensive practical exploration ability.

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