

# Exploration of the teaching mode of engineering training combining virtual and reality

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**Abstract:** This study explores an engineering training teaching mode combining virtual and reality, aiming at improving students' practical ability and innovative thinking. Virtual simulation technology is used to provide students with a real engineering environment, establish a public practice support platform for students. Students can engage in practical operations and teamwork to cultivate their ability to solve practical problems. The results show that this teaching mode can effectively improve students' learning interest, learning effect and ability, and is of great significance for training senior talents in the engineering field.

**Key words:** virtual-real combination; engineering training; teaching mode; practical ability; innovative thinking

## 1 Introduction

With the continuous development and application of modern science and technology, engineering training and teaching play an important role in cultivating senior talents in the field of engineering. However, there are some problems in the traditional teaching mode of engineering training, such as the limitation of practice environment and the disconnection between theoretical knowledge and practical application. Therefore, the purpose of this study is to explore an engineering training teaching model that combines virtual and reality to improve students' practical ability and innovative thinking.

Through the introduction of virtual simulation technology, the virtual-real engineering training teaching model provides students with a real engineering environment, establishes a public practice support platform for extracurricular science and technology activities, and promotes students' hands-on operation and team cooperation. This can make up for the deficiency of traditional engineering training teaching mode and improve students' learning interest, learning effect and ability quality [1].

## 2 Current situation of engineering training and teaching

### 2.1 Current situation of domestic engineering training and teaching

The current situation of domestic engineering training and teaching presents diversity. Many colleges and universities pay attention to the explanation and study of theoretical knowledge in teaching activities, and train students' professional quality by teaching related courses. This traditional teaching method mainly focuses on the imparting of theoretical knowledge, allowing students to understand the basic theories and principles in the field of engineering through classroom learning.

Some colleges and universities have begun to implement the combination of virtual and real engineering training teaching model, giving students more practical opportunities and practical operation opportunities. For example, some colleges and universities will organize students to carry out field visits and experimental operations of engineering projects, so that students can personally participate in engineering practice and consolidate and apply the engineering knowledge they have learned through practical operations [2].

At present, the model of engineering training and education combining virtual and reality has been gradually valued and popularized in some colleges and universities in China. However, there are also some problems and challenges, such as the limited teaching resources, unreasonable curriculum settings and so on. Therefore, the reform and improvement of domestic engineering training and teaching need to be further explored and studied.

## 2.2 Current situation of foreign engineering training and teaching

In foreign countries, engineering training and teaching have also been widely used and explored. In the United States, the United Kingdom and other developed countries, the combination of virtual and real engineering training teaching mode has become the mainstream.

In the United Kingdom, many universities have adopted project-driven learning methods, allowing students to solve practical problems through practical projects and develop engineering practical ability. For example, the School of Engineering at the University of Sheffield in the United Kingdom offers a course called "Engineering Design and Practice," which cultivates innovative thinking and problem-solving skills through practical projects. The School of Engineering at the California Institute of Technology (Caltech) has established a number of practical projects and laboratory courses that enable students to learn and apply what they have learned in real-world situations. These projects not only include basic engineering practices, but also involve interdisciplinary cooperation and the cultivation of innovative thinking. German engineering colleges and universities generally implement the "dual system" education, emphasizing the cultivation of students' application ability in engineering practice. Nanyang Technological University in Singapore offers a series of courses centered on practical projects and enhances students' engineering practice through students' participation in off-campus internships and research projects [3].

In general, foreign engineering training teaching has formed a teaching mode characterized by the combination of virtual and reality. This model takes practical projects as the core, through the combination of theoretical knowledge, to cultivate students' engineering practice ability and innovative thinking, which is conducive to students' all-round development. Domestic engineering training and teaching can learn from foreign experience, strengthen the combination with practice to enhance students' comprehensive ability and innovation ability.

## 3 Teaching reform and effectiveness

According to the current teaching system and mode of industrial training, combined with the actual situation of the school, the reform of engineering training is mainly reflected in the following aspects: (1) expand the teaching content and introduce virtual simulation teaching module; (2) build an innovation platform and cooperate with associated schools and enterprises. The content of the teaching mode combining virtual and reality is shown in Fig. 1.

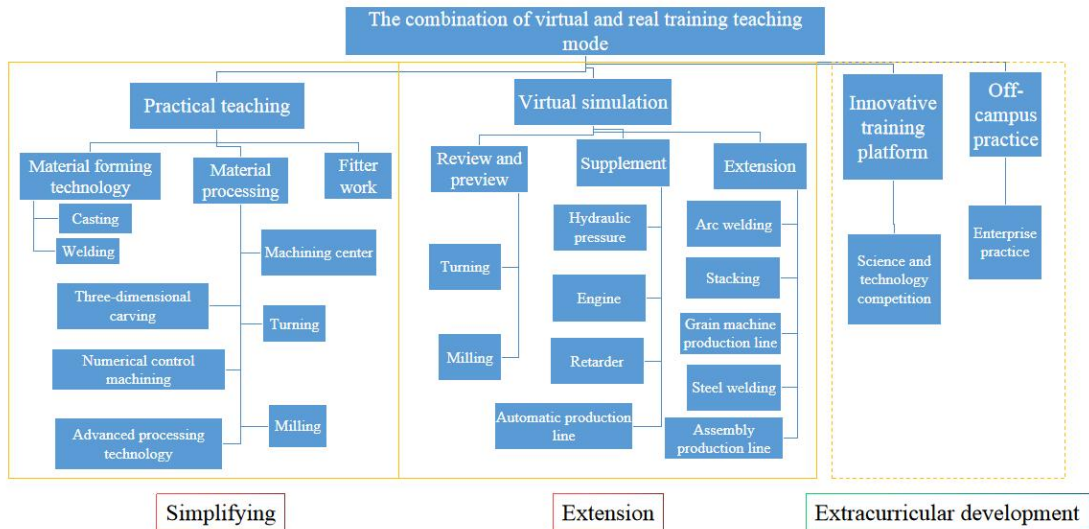


Fig. 1. Teaching content of virtual and real training

### 3.1 Expand teaching content and introduce virtual simulation teaching module

Schools and enterprises cooperate to introduce virtual simulation modules in engineering training. By combining virtual simulation technology with actual engineering training, the present engineering training teaching model provides a more comprehensive and flexible teaching method to meet the needs of talents training in the engineering field.

Taking turning as an example, it includes simple step shaft, simple thread shaft, simple bevel shaft, two-end step shaft, U-turn thread, complex thread shaft processing, etc. For example, each case includes process introduction, processing step and processing animation. Each case first analyzes the characteristics of the part as a whole, and chooses the corresponding processing technology according to the characteristics. Taking blank selection as an example, according to the specific size and processing requirements of the machined parts, select the corresponding blank, corresponding processing process card, and processing animation, as shown in Fig. 2.

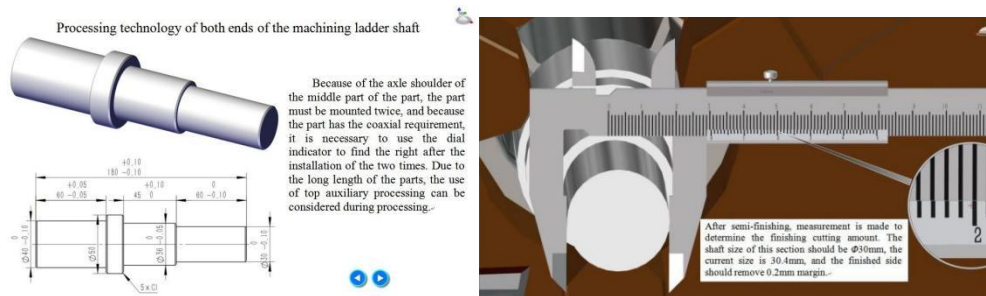


Fig. 2. Shaft machining technology

### 3.2 Innovation practice platform and school-enterprise cooperation practice

#### 3.2.1 Innovation practice platform

Establish a public practice support platform for extracurricular science and technology activities, driven by projects or competitions, including propositions or self-selected topics and projects, so that students can operate and work in teams in practice, practice theoretical knowledge in science and technology competitions, and exercise innovation ability.

Fully mobilize students' innovative design consciousness and professional learning interest, combining theory and practice to transform students' interest and potential, which is an effective carrier to cultivate students' innovative ability, an effective way to stimulate their creativity, and an important way to cultivate college students' creative spirit, team cooperation and practical ability [4].

In 2022, 101 people won the national third prize or above in various national science and technology and innovation competitions, and 211 people won provincial and ministerial level awards.

### 3.2.2 School-enterprise cooperation training

The summer training program was established with some off-campus practice bases, and some outstanding students were selected to learn professional modeling tools and practice in enterprises during the summer vacation through practical training operation exams. For two consecutive years, students have been selected to conduct summer training in enterprises.

These students performed much better than other students in subsequent participation in science and technology competitions and graduation projects. The practical training at off-campus practice bases in summer has deepened their understanding of enterprises, made their positioning clearer, and made it easy to find better positions and enterprises in employment.

## 4 Effectiveness

During the epidemic period, virtual simulation has become the main body of practical training, so that engineering training and teaching can be carried out normally. During the non-epidemic period, virtual simulation, as a part of industrial training, effectively supplements the deficiencies of industrial training content and practice [5].

The engineering training teaching mode combining virtual and reality expands the teaching content of engineering training courses, greatly improves students' engineering practice ability, enhances students' enthusiasm to participate in innovative design, cultivates students' ability to solve practical problems by using knowledge, promotes the cultivation of students' innovative ability, and comprehensively improves students' comprehensive ability. Therefore, students have a deeper understanding and thinking about employment and the future. After the implementation of engineering training course teaching reform, students' learning interest and practical ability have been greatly improved.

## 5 Conclusion

Through exploring and researching the teaching mode of engineering training combining virtual and reality, this paper aims to improve students' practical ability and innovative thinking. Through the application of this teaching mode, and combination of theoretical knowledge with practice, students can operate and work in teams in practice, and develop their ability of engineering practice and communication and cooperation, which is of great significance in the teaching practice of engineering field. Future research can be carried out from the aspects of improvement of teaching methods and the enhancement of students' ability, so as to provide more scientific and effective guidance and support for engineering training and teaching. This research has certain theoretical and practical value for education and teaching reform and personnel training.

## Acknowledgments

Teaching research project of Qilu University of Technology (Shandong Academy of Sciences) (2021yb34, 2022zd03); Shandong province teaching and research reform project (M2022105), Qilu University of Technology (Shandong Academy of Sciences) talent training project (P202203, P202209); postgraduate education and teaching reform project of Qilu University of Technology(Shandong Academy of Sciences) (YJG23YB005).

## Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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