

# A Study on the Classroom Experiential Teaching Method of Bridge Engineering Based on Classroom Simulation Subject Competition Learning

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**Abstract:** *Since the reform and opening up, China has always been on the high-speed road of development. Based on the requirements of China's own development, the demand for talents in various industries has greatly increased and continues to increase. With the continuous innovation and rapid development of Internet technology and the rise of artificial intelligence, people are more inclined to cultivate innovative talents. The bridge engineering major is one of the most popular engineering majors in the world at present, and the "bridge engineering" course is the most basic main professional course in the civil engineering major. During the learning process, students' learning interest can be better developed, so that students' independent thinking ability and innovation ability can be cultivated, and teaching can be conducted in the experiential teaching method of classroom simulation subject competition learning. So that students will have a good foundation of learning in the future work process.*

**Keywords:** *Classroom simulation, Competition learning, Experiential teaching, Cultivation of innovation and entrepreneurship ability, Bridge works*

## 1. Introduction

The major of traffic engineering, an important course of civil engineering, is the guarantee for the opening of the whole line of traffic, and is also the focus of the major of bridge engineering. This course covers a wide range of links and contents, including planning, exploration, design, construction, manufacturing, monitoring and maintenance. In the process of learning, it also involves material mechanics, structural mechanics and other courses, and needs to master the basic knowledge of engineering drawing and CAD. This course mainly aims to train students to understand some steps in the process of bridge engineering construction, understand some famous bridge structures, master some methods and skills of analyzing and designing bridges, cultivate students' ability to design, analyze and build bridges, lay a foundation for the study of subsequent courses, and further improve students' understanding and understanding of bridge engineering construction in order to ensure the smooth progress of learning [1].

## 2. Characteristics of Bridge Engineering

### 2.1. Strong comprehensive ability

The course of Bridge Engineering is based on the courses of engineering drawing, engineering surveying, engineering mechanics, structural mechanics, material mechanics, engineering geology, building materials, which are just the difficult points for civil engineering students to learn, and is specifically applied in bridge structures. The Course of Bridge Engineering requires that through the study of this course, students can systematically master the design and construction principles, calculation theories and methods, construction points and other aspects of various bridges, and can skillfully master the design and construction principles, calculation theories and methods of various bridges. This feature determines that the learning difficulty of the course "Bridge Engineering" is not small.

## **2.2. Higher learning requirements**

Bridge Engineering, a professional course, is mainly designed to ensure the stability of the overall structure of the bridge, confirm the design height of the bridge, the load capacity of the bridge structure, and the design route and traffic requirements of the bridge under the condition of beautiful appearance of the bridge. It is one of the engineering disciplines with relatively high professional requirements. The major of bridge engineering is the most basic backbone of the major of traffic engineering, and also the major of civil engineering. In the process of learning, students need to master the basic knowledge of engineering drawing and CAD, and learn and master the courses of Mechanics of Materials, Structural Mechanics, Civil Engineering Materials, and Principles of Reinforced Concrete. Students are required to have a certain understanding of the structural principles of general small and medium-sized bridges. Therefore, the major of bridge engineering is the most basic major of bridge engineering in China, and can be familiar with the relevant knowledge of bridge construction, so that students can further develop the design, analysis and construction ability of bridges[2-3].

## **2.3. There are many knowledge points in the course content, and the teaching process is boring**

The course "Bridge Engineering" has a lot of contents, including the basic concept of bridges - the basic composition, classification, characteristics, adaptability and other aspects of bridges. The course "Bridge Engineering" mainly describes the basic design of bridges: the type selection of bridges, the overall layout of bridges, the design principles of structural design, the structural design of bridges, the calculation of bridges and bridges: bridge structures (connecting beams, cantilever beams, T-shaped rigid frames, etc.) Other calculation points such as load selection, load calculation and combination are the basic calculation content and calculation method of bridge structure (simple supported beam and arch bridge). Bridge construction method: the construction steps of each construction method applicable to the bridge type and scope. The above contents are connected again.

## **2.4. Strong practicality**

"Bridge Engineering" is a comprehensive deepening of the basic course, involving a wider range of knowledge and a more practical course. Students are required to apply what they have learned and apply what they have learned, that is, to understand, understand and apply what they have learned. It can be seen that bridge engineering is a comprehensive, practical and multidisciplinary course, which requires spatial imagination and can be better grasped and understood only by perceptual knowledge, experience and structural diagrams[4-5].

## **3. Problems in traditional teaching methods**

### **3.1. Obsolete teaching mode and single teaching method**

The traditional course of bridge engineering is mostly crammed. The teachers teach on the platform in strict accordance with the knowledge structure system of the course itself, such as the composition of the bridge structure, the calculation of the components, and the construction method. Although they pay attention to the knowledge structure system of the course itself, they ignore the practical characteristics of the bridge engineering, and rarely apply the bridge knowledge to practice. In the teaching process, the teachers have a great lack of understanding and understanding of the bridge knowledge in the teaching process, we have really achieved the goal of applying what we have learned. Students lack interest in learning and are faced with boring formula derivation and modular calculation. Therefore, through the actual teaching, it is found that although a large number of bridge structure materials are provided in the classroom and the calculation principle of bridge structure is repeatedly described, many students cannot imagine the composition and mechanical characteristics of bridge structure, which makes most students feel very difficult to master the introduction and knowledge points of the course.

### **3.2. Improper selection of cases in the textbook, which is out of line with the examination outline**

The course outline of Bridge Engineering requires to master the current situation and development, structure and design, construction, calculation and other aspects of small and medium-sized span bridges, and is accompanied by wonderful content, which mainly introduces the history of bridge

development in the world and in China, the current situation of bridges, the ranking of the largest span of various bridges and other teaching materials and cases, supplemented by the landmark building pictures of bridges around the world, making people dizzy. Therefore, students are very interested in learning "Introduction to Bridge Engineering", but after entering the beam and arch bridge teaching, due to the general teaching materials and reference books, students cannot find the corresponding cases when learning the beam and arch bridges with small and medium-sized spans, and their interest in learning is gradually fading[6-8].

### ***3.3. Laboratory construction lags behind***

There are many experiments to be done in the course of bridge engineering, which can only be completed with professional equipment such as displacement meter, strain gauge, stress gauge, etc. Because the equipment is relatively old, it will make it difficult for students to experiment, especially for graduates to find jobs, which will have a greater negative effect. In addition, the lack of some books and materials has caused some obstacles to daily teaching. Professional theories, engineering technical standards, design specifications, construction specifications, and related design software, teaching aids, etc. at home and abroad are all matched with the curriculum, which has caused some difficulties in teaching.

## **4. The current training mode in colleges and universities lacks the training of innovative ability**

The purpose of engineering education is to train students to be an excellent engineer with professional technology, practice and application ability and social awareness as well as the quality of engineering innovation. However, at present, there is a common phenomenon in colleges and universities that attaches importance to theory, neglects practice, attaches importance to knowledge teaching, neglects ability training, and lacks innovative teaching atmosphere. This phenomenon reflects one of the biggest drawbacks of China's talent training model. These are also highlighted in the training of civil engineering professionals.

## **5. The role of discipline competition in cultivating innovative talents**

### ***5.1. Training of students' innovative thinking***

The student-centered science and technology competition activities completed by students independently, from topic selection, design, production to paper writing, each link and step, have greatly exploited the students' thinking ability of active creation, and well developed the students' awareness of active thinking and active creation. In the continuous design experiment, it also exercises students' divergent thinking ability and stimulates students' creativity and imagination. The universality of the knowledge used in the competition encourages students to learn a lot of extracurricular comprehensive knowledge, and at the same time, learn to summarize and analyze, and cultivate the ability of logical and innovative thinking. This is the universality of the knowledge used in the competition.

### ***5.2. Influence on students' quality of science and technology entrepreneurship***

The science and technology competition has not only broadened the way of entrepreneurship education in schools, but also become a good carrier for cultivating students' entrepreneurship ability. By cultivating students' innovation ability, it has provided a good foundation for students' entrepreneurship. Higher education should adhere to the road of combining production, study and research to promote the transformation of scientific and technological achievements and cultivate practical talents of application and entrepreneurship. A large number of outstanding talents trained through science and technology competitions are becoming new forces in science and technology entrepreneurship. The title of the science and technology competition is close to the reality of engineering. While reflecting the direction of professional application, it consciously invests in scientific research activities and accumulates experience in the process of entrepreneurship, which can also consolidate students' professional thinking[9].

## **6. Teaching reform measures**

### ***6.1. Simulated discipline competition to cultivate students' innovative and entrepreneurial thinking***

Sponsored by the main responsible department of the school, each secondary college undertakes a series of innovation and entrepreneurship lectures, carries out targeted professional guidance and training for teachers and students, and holds various forms of innovation and entrepreneurship activities and basic events in a relatively centralized manner at the same time, such as "Challenge Cup", "Science Festival", "Innovation Youth", "Internet plus Competition" and other series of events. In terms of project mining, simulation universities, as innovation and entrepreneurship highlands, mainly take the "Internet plus" college students' innovation and entrepreneurship competition as the main form. Carry out entrepreneurial projects with potential and characteristics based on "bridge structure design". It can be solved by: First, from a professional point of view, by analyzing the problems in the current market that cannot be solved well, but can be solved by the technology or means of the bridge specialty you have learned. Second, From the perspective of the market, we should study the direction of policy encouragement again, and use our own methods to help and solve it. Third, From the perspective of interest, interest is the best teacher. With enough interest, we will not give up halfway if we encounter any difficulties in practice. Fourth, From the perspective of family business, the model can be upgraded to establish a project. Fifth, From the perspective of scientific research, join the scientific research team, accumulate experience and skills, and lay a good foundation for future innovation and entrepreneurship[10].

### ***6.2. Orthogonal test method is proposed to construct the teaching mode of innovation and entrepreneurship ability group and "gradual release of responsibility" method***

Test various factors and different levels of various factors from the aspects of students' self-learning ability, leaping thinking, scientific autonomy, innovation and other abilities as factors, and optimize them through multiple factors, so as to build an innovation and entrepreneurship ability group. Through "gradual release of responsibility", teachers will still play a major role at the beginning of a class or when new materials are introduced. For all courses, teachers should establish the goals and objectives of the course of the day at the beginning. In this step, the teacher will use a model to directly guide a concept. Teachers can attract students by demonstrating tasks or giving examples. The direct guidance in this part will set the tone for the course, so the participation of students is crucial. Some scholars suggest that when teachers create models, all students should put down their tasks. Keeping students focused can help students who may need extra time to learn these contents. Teachers and students participate in interactive teaching. The teacher can directly prompt or provide clues to the students. What students can do is not only to listen, but also to have the opportunity to learn. The teacher can determine whether additional modeling is required at this stage. The use of continuous informal assessment can help teachers decide whether to support students with more needs. If a student misses a key step or lacks a special skill, the teacher can help immediately. The student can practice and demonstrate his or her understanding of the teacher's guidance process alone or in cooperation with his or her peers. Cooperative students may seek help from their peers, which is a form of reciprocal teaching aimed at sharing results. At the end of this step, students will rely more on themselves and their peers, and less and less on teachers to complete learning tasks. This teaching method follows a step-by-step process, in which teachers do less and less, and students gradually accept that they have more and more responsibility for their learning. The responsibility of gradual release can be extended for one week, one month, or one year. During this period, students develop their ability to become capable and independent learners.

## **7. Conclusions**

Teaching "Bridge Engineering" in the way of simulating discipline competition is conducive to cultivating students' innovation and entrepreneurship ability. Innovation and entrepreneurship is a way of life for contemporary college students, which can test learning achievements in practice, start businesses with majors, release innovation vitality, display entrepreneurship style, and better realize life pursuit. In terms of teaching methods, it plays an important role in promoting the integration of production and teaching, technological innovation, and the development of applied skills. Explore the integration of local economic development needs and professional talent training plans of colleges and universities. While providing intellectual talent support for enterprises, open a second class outside the

school, open an optional course of innovation and entrepreneurship for college students, provide entrepreneurship platform for college students, and integrate local characteristics and professional characteristics. Create a teaching practice base, create a guidance team for the innovation and entrepreneurship teaching system, explore the construction of an evaluation system for the innovation and entrepreneurship growth of college students, and give new connotation to the era of innovation and entrepreneurship.

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