

# Evaluation system and application of classroom teaching reform of Bridge Engineering based on classroom simulation subject competition learning

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**Abstract:** *The simulated subject competition of college students plays an extremely important role in cultivating students' self-learning ability, innovative thinking, practical ability and innovative ability. The teaching of bridge engineering specialty is based on the discipline competition, aiming at the cultivation of application-oriented talents, and exploring the multi-angle and multi-level professional talent cultivation mode from theory to practice. This paper considers the existing problems and puts forward the training mode of "simulating subject competition learning in class" to train students' engineering practice ability and innovation and entrepreneurship ability.*

**Keywords:** *Discipline competition learning; Bridge engineering; Classroom teaching reform; Evaluation system*

## 1. Introduction

The course of bridge engineering is an important course that constitutes the major of civil engineering, is the key to traffic engineering, and is also the guarantee for the opening of the whole line. This course involves a wide range of links and contents, including planning, exploration, design, construction, manufacturing, monitoring and maintenance; The main course content involves reinforced concrete and prestressed rod concrete beam bridge, etc. The main purpose of this course is to train students to understand some steps in the construction process of bridge engineering, understand some famous bridge structures, and master some methods and techniques for analyzing and designing bridges, so as to lay the foundation for the subsequent courses and ensure the smooth progress of learning.

## 2. Problems in bridge engineering teaching

### 2.1. The teaching objectives of the course are not clear

The specialized courses of bridge engineering involve engineering mechanics, structural design and construction, bridge engineering survey and other related disciplines. The clarity of teaching objectives of the specialized courses is one of the factors that determine the success or failure of bridge construction. However, in the survey of teaching evaluation of some students, it was found that many students lacked systematic knowledge of bridge structure, which led to poor understanding and mastery of bridge structure in the design and construction process, unclear understanding of stress levels of different types of bridge structures, and prone to stress deformation or crack problems. Therefore, students generally feel that the lack of basic knowledge in the design and construction stage is the main obstacle in the course teaching.

### 2.2. Weak sense of innovation

In engineering practice teaching, students often complete construction tasks in a construction unit. Therefore, most schools only attach importance to the teaching of theoretical knowledge and the training of basic skills, rather than the comprehensive application of practice. Schools, teachers and students have a weak sense of entrepreneurship. The main body awareness of innovation and entrepreneurship education in schools is not in place<sup>[1]</sup>. Some schools have not established advanced

innovation and entrepreneurship education concepts. Innovation and entrepreneurship education is managed separately, the system and mechanism are not sound, educational resources are not centralized, and the atmosphere of innovation and entrepreneurship is not strong. At the teacher level, the composition of the teaching staff is too single<sup>[2]</sup>. The professional course teachers have limitations in their understanding of the concept of innovation and entrepreneurship education and are not enthusiastic about innovation and entrepreneurship. Students despise the training of practical ability, have no clear understanding of the advantages of innovation and entrepreneurship, and lack the ability to combine theory with practice. The innovation and entrepreneurship ability is the core indicator to measure the quality of innovation and entrepreneurship education in colleges and universities<sup>[3]</sup>. Bridge structures are widely used in China's transportation industry. With economic development and technological progress, the quality requirements for transportation infrastructure are also increasing. Practical teaching is a comprehensive teaching activity aimed at cultivating students' professional skills. During this period, we should reasonably arrange the time arrangement of course experiment courses and practice base construction, and gradually improve the practice mechanism on this basis.

### ***2.3. Theory is greater than practice***

When observing and visiting the actual teaching of the bridge engineering course in real universities, we can easily find that the students who sit in the classroom pay too much attention to the study of theoretical knowledge, but neglect to cultivate the students' practical ability, resulting in the wrong guidance of "theory is greater than practice", which directly leads to the students' empty stomach of "theory" after learning this course, but "can't move". There is a serious disconnect between students' "theory" and "practice", and students have no way to apply the knowledge they have learned to practical work.

## **3. Promote the reform of the practical teaching of the discipline "Bridge Engineering" and the cultivation of the innovative ability of college students through the classroom simulation subject competition**

### ***3.1. Practical teaching orientation***

Only when the teaching orientation is accurate can we reform the teaching content and methods according to the practical teaching orientation. At present, the orientation of practical teaching is unclear. Many teachers only regard it as an attachment to the theoretical course, and the practical course is only the verification and repetition of the theoretical course, resulting in low enthusiasm of students and poor practical effect. According to the characteristics of engineering education and the needs of the society for talents, it is required to train students who can solve practical engineering problems. Therefore, the orientation of practical teaching should be to cultivate students' hands-on ability and ability to solve practical problems<sup>[4]</sup>. After repeated practical training, students' innovative ability will be developed.

### ***3.2. Reconstruction of practical teaching content***

Subject competitions have been very popular with students in recent years, and both the competition and the competition have shown a positive trend<sup>[5]</sup>. Through research, the author found that the discipline competition is to integrate the daily knowledge points into practical problems, and the competition topics are applied, so that students consolidate their existing knowledge and solve problems. The students feel very successful and highly motivated. The actual effect of discipline competition is consistent with the orientation of practical teaching. Then, we can learn from the discipline competition and reconstruct the content of the practice course. Reduce the proportion of verification experiments in current practice teaching and increase comprehensive and design experiments<sup>[6]</sup>.

The first is the confirmatory experiment, which is conducted in the first eight weeks of the semester. It is mainly to verify the knowledge points in the theoretical class, and the purpose is to enable students to practice the knowledge in the theoretical class in a timely manner to achieve proficiency.

The second is comprehensive practice. The time is 9-13 weeks of the semester. The purpose is to comprehensively apply the knowledge learned in the previous period to achieve the effect of understanding.

The third is the design practice, which lasts from 14 to 18 weeks of the semester. The purpose is to enable students to solve practical problems based on the theoretical knowledge they have learned and the accumulated practice in the early stage. Through the design of hierarchical teaching content, the difficulty of practical teaching increases layer by layer, so that students can exercise step by step and improve their innovation ability.

### ***3.3. Reform of practical teaching methods***

The current practice class is teacher-oriented, and students practice step by step under the guidance of teachers<sup>[7]</sup>. This is not conducive to stimulating students' autonomy in learning. It is often because after a practice class, students feel that they have not learned anything new. Especially for some students who have a quick grasp and strong practical ability, they can often complete the tasks assigned by the teacher very quickly. If this practical teaching method is used for a semester, they will gradually lose their interest in practical lessons. So how to formulate different practical methods for different levels of students?

In some discipline competitions, different groups will be set up. Players from different levels of colleges and universities or from the same college can choose their own groups. In this way, we can expand the audience of the competition and attract more colleges and students to participate in the competition. At the same time, the discipline competition is usually set up as a task for the participants to complete. In the process of completing the task, the contestants not only consolidated their existing knowledge, but also learned new skills and improved their innovation ability. With reference to the discipline competition, we can adopt the grouping teaching and task-driven teaching methods in the practical teaching. For students at different levels and levels in a class, group teaching is implemented. Each group has a part of high-level students to help each other within the group and improve the hands-on ability and innovation ability of all students. At the same time, our college has specially set up innovative courses related to competitions, which are optional courses. Students can choose courses of different difficulty according to their own level, and carry out hierarchical teaching. Such teaching is more targeted.

## **4. A case study on the evaluation system of classroom teaching reform of "Bridge Engineering" based on classroom simulation subject competition learning**

### ***4.1. Reform strategy***

Taking the Middle School Attached to Northeast Normal University as an example, after establishing the basic logic of classroom teaching reform with the concept of school classroom education as the starting point and the requirements of the national education reform as the goal, the Middle School Attached to Northeast Normal University aims to "realize the overall expansion of curriculum education function and steadily improve the internal system of teaching quality"<sup>[8]</sup>, and systematically promote long-term thematic teaching reform experiments or teaching research activities, It aims to eliminate the gap between educational reform requirements and teaching practice with action research. Long-term thematic teaching and research is the main method of action research to promote classroom teaching reform in the middle school attached to Northeast Normal University, that is, with the mind of embracing all kinds of rivers, the frankness of confrontation, and the courage of innovation, in the practice of classroom teaching reform in schools, one theme each year, a little change each time, and finally accumulated into classroom teaching behavior improvement strategies, in order to shape a new classroom teaching culture and promote the in-depth development of education reform, Promote the high-quality development of the school.

### ***4.2. Reform results***

In the past decade, the classroom teaching reform of the Middle School attached to Northeast Normal University has changed from relatively independent classroom teaching demonstration activities to systematic classroom teaching reform activities. Through a large number of action research, the school has gradually promoted the change of teachers' understanding of classroom teaching reform while constantly enriching the connotation and extension of classroom teaching, and continuously injected new impetus into the quality improvement and high-quality development of the school.

#### ***4.2.1. Personalized and connotative classroom teaching reform concept is deeply rooted***

Before 2012, the focus of school education is still to promote the optimization and improvement of school classroom teaching details through the accumulation of phased curriculum reform experience, such as teaching preparation, teaching process, teaching materials, teaching evaluation, teaching management, etc. With the deepening of the classroom teaching reform, the school's classroom teaching reform has also begun to develop towards a new education concept, characteristic teaching form and characteristic teaching concept beyond the mode and technology level. For example, the view of students has changed from individual growth to the coordinated growth of individuals and society, the view of classroom has changed from formed classroom to generative classroom, and the view of teaching has changed from student main body to teacher and student dual main body emphasizing good intersubjectivity. The individualized and connotative classroom teaching reform concept of the Middle School Attached to Northeast Normal University also has an impact on the future development orientation of the school. After 2017, the development orientation of the school has changed from the original first-class middle school and well-known middle school "to a modern and international academic middle school"<sup>[9]</sup>, 18% of which reflects the change from abstract to concrete and from extension to connotation, marking the qualitative change of the school's development logic.

#### ***4.2.2. The teacher training strategy adapted to the needs of future education development is gradually mature***

The classroom teaching reform of the middle school attached to Northeast Normal University is essentially a bottom-up, internal and external teaching reform. Because teachers are the organizers and designers of classroom teaching, teachers naturally become the main body of classroom teaching reform. The change of teachers' role in the reform of classroom teaching, on the one hand, directly promotes the professional growth of individual teachers, on the other hand, indirectly promotes the change of teachers' overall education concept. In the classroom teaching reform activities, teachers have standardized their teaching behaviors, improved their understanding of curriculum development and design, implementation and evaluation, and rapidly improved their professional level through careful preparation, repeated grinding, careful teaching, and deep reflection. Through the experience and ability gained in the classroom teaching reform activities, teachers' professional recognition has been greatly improved, and they have more deeply felt the value of their own existence, Realize the sense of professional happiness and achievement. The personalized and connotative development model of teachers has also indirectly promoted the transformation of the concept of school teaching inclination. Before 2012, the focus of school teacher development was the cultivation of skilled teachers in teaching technology; After 2012, the school gradually shifted the focus of teachers' development to the cultivation of teachers' reflective ability, research ability and academic ability, aiming to help teachers break through the professional bottleneck of skilled skills and grow into educators with noble ethics, advanced concepts, efficient teaching and academic excellence<sup>[10]</sup>.

Throughout the practice of classroom teaching reform in the Middle School attached to Northeast Normal University for more than 70 years, we can summarize the four characteristics of "provincial origin, long flow, local establishment, and Taoist students". At the beginning of the establishment of the school in 1950, the orientation of the affiliated middle school of the Northeast Normal University to the nature of "experimental middle school" and the development orientation of "the necessary experiment and research work of educational theory and teaching methods should be carried out" are the source of the reform of classroom teaching in the affiliated middle school of the Northeast Normal University for many years; The research theme of the last decade is "flow"; Taking root in the classroom and returning to the origin of the common growth of teachers and students is "Ben". The local original subject teaching idea, the ideological and political classroom teaching reform of the high integrated curriculum in the early childhood, the "four in one" classroom education concept and the "five in one" teaching guiding ideology in the new era are "Tao".

## **5. Conclusions**

With the continuous development of engineering education and bridge industry in China, the number of bridge courses and related projects in major universities in China is increasing, and universities are also actively reforming the talent training mode. In order to adapt to social development and social needs, the training of bridge professionals has been reformed with the goal of adapting to social needs. However, there are still many problems in the bridge cause of colleges and universities in China. At present, in the cultivation of bridge talents in colleges and universities in China, the mode of

talent cultivation has not fully adapted to the needs of social development. Therefore, in the future research, it is necessary to fully consider the problems existing in the training mode of bridge engineering professionals in China's universities and carry out corresponding reforms.

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