

# Thoughts on the Teaching of Bridge Engineering Construction Course based on Industry-University Cooperation

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**Abstract:** With the gradual advancement of education reform in institutions of higher education in China, the pattern of industry-university cooperation has gradually entered colleges and universities. Industry-university cooperation has played a very important role in solving the problem of the disconnection between education and teaching in colleges and universities and enterprise demands, so it has received much attention in recent years. This paper mainly introduces that the industry-university cooperation is a necessary condition for the development of bridge engineering construction courses in colleges and universities. Through the specific analysis of this cooperation mode, combined with the specific practice, the thoughts on teaching of bridge engineering construction course based on industry-university cooperation is given.

**Keywords:** Industry-university cooperation; Teaching reform

## 1. Introduction

The bridge engineering construction course based on industry-university cooperation is a professional course with equal emphasis on theory and practice, involving bridge planning, surveying, design, construction, production, testing, maintenance, reinforcement and other steps. With the rapid development of bridge construction in China, the requirements for bridge courses are gradually improved, and the reform of bridge engineering courses is also imperative.

“Talent is the primary productive force”, and the level of professional talent training in institutions of higher education or vocational colleges will greatly affect the development of national and local enterprises. Therefore, local colleges and universities must make appropriate adjustments according to local characteristics and uniqueness, especially in cultivating relevant professional and technical personnel. The level of development of each major in local institutions of higher education and vocational colleges will closely affect the level of development of the areas served. However, many colleges and universities do not reasonably set the teaching content of each major, and do not proceed from the actual situation of the development and construction of local enterprises, thus leading to a series of problems such as the fact that talent training methods are separated from the actual construction of local enterprises. In addition, the volume of modern traffic is expanding, and the requirements for bridge engineering professionals are further improved. How to master the professional skills for students

through curriculum reform is an urgent problem to be explored and solved.

## 2. The Importance of Industry-University Cooperation in the Teaching of Bridge Engineering Courses

Colleges and vocational colleges are the gathering place of innovative talents and the birthplace of innovation achievements. Achieving industry-university cooperation in colleges and vocational colleges not only enables professional education to closely match market needs, but also enables students to adapt to corporate positions more quickly.

### 2.1. Development of industry-university cooperation

The pattern of industry-university cooperation is an important way for many colleges and universities to carry out curriculum reform and development. Industry-university cooperation can also be called school-enterprise cooperation. School-enterprise cooperation education was first produced in the United States. The educational form of industry-university cooperation was produced in Germany at the end of the 19th century. In 1897, Germany had a vocational education of dual-system, and its essence was school-enterprise cooperation, which is a starting point for school-enterprise cooperation education. Achieving industry-university cooperation is not only a necessary condition for economic and social development, but also a concrete implementation of the student-oriented concept, thus cultivating students' competence and professional qualities. The so-called

industry-university cooperation, "industry" refers to industry and enterprises, such as bridge construction enterprises; "university" refers to the academic community, such as universities, research institutes and other scientific research institutions. Industry-university cooperation is sometimes called "industry-university and research cooperation." Students can enrich their horizons by reaching out to the education of corporate teachers. Therefore, colleges and universities urgently need to update the concept of industry-university cooperation, timely innovate the mode of industry-university cooperation, improve the specific ways of industry-university cooperation, and then build a complete training model for industry-university cooperation. Through the new model of industry-university cooperation, students can get certain practical opportunities for engineering exercises, and can use the learned knowledge theory to solve practical engineering problems. Through industry-university cooperation, schools can use some classic bridge construction cases as teaching resources to enrich the practical experience of young teachers in colleges and universities, optimize the assessment methods of bridge courses, and realize double investigate from a single course examination to a theoretical and practical ability.

## **2.2. The necessity of industry-university cooperation in bridge engineering**

The bridge engineering major is a highly practical profession. Practical teaching is an important way to train high-quality technical skills talents, which directly affects the training quality of road and bridge construction talents. Therefore, perfecting the construction of the practical teaching system of bridge engineering is of great significance to improve the professional ability, quality ability and comprehensive ability of the students to meet the needs of the development of the transportation industry. Now, the introduction of the industry-university model solves problems of the lack in the practical teaching system of bridge engineering. In institutions of higher education and vocational schools, the combination of industry-university education and talent training has become a recognized approach to the cultivation of applied talents in the international vocational education community. Many countries have adopted different implementation guidelines and measures according to their own circumstances. It is an operational mechanism oriented to market and social needs, with a focus on cultivating students' comprehensive qualities and practical abilities. For bridge-related enterprises, the combination of industry and university provides the quality of employees, reduces the cost of enterprise reform and innovation, and increases the capital and potential of development. Therefore, the implementation of the bridge engineering construction course reform based on industry-university cooperation is very important.

## **3. The Main Problems in the Teaching of Bridge Engineering Courses in Industry-University Cooperation**

### **3.1. The teaching curriculum itself is characterized by practice, but the students generally lack adequate training**

The bridge structure system is complex and changeable, and it is very difficult for students to imagine the structures. Most of the students only have a basic understanding of the external structure of the bridge, but their spatial structure is not sufficient for their internal structure. For students who are new to bridge engineering, there is no specific concept or structure of the bridge in their mind, so it may be difficult to understand the principles of bridge construction. And most of the students themselves focus on the theory and despise the practice, only pay attention to the design and neglect the construction. The teaching is too biased towards theorization, and the teaching is introduced into the situation where the theory and practice are out of touch.

### **3.2. Disconnection between teaching content and the new achievements of bridge technology**

With the development of China's transportation infrastructure construction, bridge construction technology is advancing with the times. The new bridge structure, new design theory and bridge construction technology are advancing rapidly. The pace of technological development far exceeds the scope of the current textbook. However, the PPT in the classroom and the materials used by the school have not changed over the years. The textbooks currently used are usually summarized for the level of bridge construction three to five years ago, but the research on bridge engineering is constantly advancing, and knowledge reserves are increasing, but it is rarely introduced in the classroom, so students have the illusion that the knowledge they are learning is outdated. What is more, students may be tired of learning. The update of actual engineering case of the teacher's teaching cannot keep up with the latest technology. This also leads to students' tired learning, passive acceptance, and lack of learning initiative, which is not conducive to students' self-innovation. This relatively backward teaching method and teaching content will also hinder students' creativity in imagining the bridge structure. Therefore, in order to better pass the latest technology to students in a timely manner, it is necessary to explore a better teaching method and timely and quickly add the latest technology to modern theoretical teaching.

### **3.3. Teaching time is reduced, while teaching content is increased**

In the course of bridge engineering, the number of teaching hours is limited and reduced. In addition to the introduction of theoretical courses of the system, this course also urgently needs to be further studied in combination with practical courses. The bridge project itself requires a lot of practices, but there is no real guarantee for the practice time of the teaching plan. Then, how to explain the most comprehensive, cutting-edge theoretical knowledge and ensure the practical training ability in the limited class time is the key issue that need to pay attention to in the following teaching.

### **3.4. The system of industry-university cooperation has not been established and improved**

Through the cooperation of schools and enterprises, some colleges and universities of bridge engineering cooperate with some design and construction enterprises. In addition, colleges and universities also carry out research on related topics through education reforms, so as to continuously strive for the talent needs of local enterprises, improve the overall teaching effect and teaching efficiency, and cultivate each student to use theoretical knowledge to truly solve the actual situation. Have students acquire professional knowledge and become qualified personnel in the field of bridge engineering. However, through actual investigations, many school-enterprise cooperation is very narrow. The main problems are: First, whether the contract content is scientific and systematic. Through this contract, whether the school and enterprise can correctly understand their role in cooperation, and guarantee the equality of the subject status; second, whether the result transformation system is regulated. Especially the school-enterprise cooperation, the interests of the people involved in the project for design and construction are difficult to achieve fairness and justice, which may lead to cooperation is difficult to maintain.

## **4. New Mode of Industry-university Cooperation in Bridge Engineering Course**

### **4.1. Promote advanced teaching methods and ensure teaching quality and teaching efficiency**

In the classroom teaching process, the actual bridge construction video teaching, construction animation teaching, pictures and other means are used to enrich the students' imagination. It can not only enhance students' intuitive understanding of complex bridge structures, but can also save classroom board time, improve teaching efficiency and enrich classroom interest. In addition, combined with the actuality of bridge engineering, heuristic teaching and discussion-based teaching were introduced to form a new teaching mode of "taking students as the main body and teachers as the guide". For the rectification of the teaching content under the new mode, it is possible to jointly study related courses and jointly compile corresponding

teaching materials through school-enterprise cooperation. According to the actual needs of the enterprise, the curriculum objectives can be set, and after the course objectives are determined, the appropriate teaching content, teaching methods and teaching organization forms are selected to try to meet the requirements of the course objectives. The industry-university cooperation course should proceed from practice and truly understand the relevant technical needs of counterpart enterprises, so as to sum up the theoretical knowledge and technical skills that the professional training objects of bridge engineering should be possessed, and determine the course objectives and teaching content.

### **4.2. Set up a school-enterprise cooperation to form a technology innovation service platform**

In order to achieve better transfer of the latest technology to students, colleges and universities can establish a technology innovation service platform through cooperation with enterprises, integrate university education and industry enterprises, build a modern bridge engineering professional talent training overpass, industry enterprises participate in professional construction. In the whole process of talent training, the implementation of the professional learning direction of the deployment will form a close-knit cooperative education system mechanism for talent sharing, process sharing, achievement sharing and responsibility sharing between the school and the enterprise. In the school-enterprise cooperation, teachers with skilled theory and skilled engineers can be hired to form a teaching team to further develop existing teaching resources and further promote the exchange of teaching and practical experience.

### **4.3. Establish a school-enterprise joint training base and technical exchange base**

In view of the current dilemma of limited teaching hours, colleges and universities can cooperate with enterprises to build a talent training base and technical exchange base to deepen the theoretical knowledge and enhance hands-on practical ability. Increase the length of practical teaching, arrange professional on-the-job internships, and ensure the practice of internships and effect; improve the management of internships, determine stable internships, and allow students to go deep into the production line and combine bridge engineering theory to conduct practical learning so as to make up for the inadequacies of classroom teaching.

### **4.4. Constructing a new mode of talents training for industry-university cooperation**

The new model of school-enterprise cooperation can start from the integration of school-enterprise, integration of work and study, and integration of doing and learning. It truly combines theoretical study with practice and unifies

the needs of enterprises and the direction of colleges and universities. In response to the call of the Ministry of Education, domestic and foreign well-known enterprises are selected to cooperate and set up projects to establish industry-university cooperation, collaborative education, and innovation of university personnel training mechanisms. In order to achieve better practical results, students are allowed to participate in specific projects in the process of communication, and enhance the ability to use manual brains, that is, encourage students to build bridge models, participate in bridge design competitions, and exert their innovation, so that both schools and enterprises can build bridges, focus on cultivating high-quality talents that meet the needs of industrial development, and provide a good talent base for enterprise development.

## 5. Conclusion

In summary, industry-university cooperation is the necessary direction for the development of bridge engineering. The bridge engineering major develops with a combination of construction enterprises, which has greatly improved the overall benefits. Universities and vocational schools have gradually recognized the importance of industry-university cooperation, so they have begun to put into practice in reality. However, due to the backward teaching methods and outdated teaching contents in the past, there is no effective support for system for industry-university cooperation in teaching and administration. It is still in the exploration stage, and the deep cooperation

between universities and enterprises still needs a long period of time. In the process of cooperation with enterprises, college teachers should continuously enhance the awareness of industry-university cooperation, so as to impart knowledge, train students thinking of solving practical engineering problems, and participate in engineering practice. Colleges and universities should establish cooperative relations with enterprises related to the industry, realize effective communication between universities and enterprises, further integrate high-quality resources, and establish a multi-level and all-round system to achieve better bridge engineering construction courses based on industry-university cooperation. Seek a more promising future in the collision of academic and technological exchanges.

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