

Research on the Teaching Reform of Bridge Engineering based on the Training of Engineering Application

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Abstract. Guided by engineering application, according to the teaching status of the Bridge Engineering course in our university, the teaching reform was carried out under the consideration of syllabus, teaching methods, practice teaching, curriculum design, map reading ability enhancement, introduction of bridge cultural history, expansion of innovation ability, penetration of industry norms and establishment of network teaching resources, with the guidance of engineering application. This not only meets the requirements of professionals in the field, but also meets the needs of career development. According to the preliminary effect of the reform in the past three years, the plan had achieved certain results, which means a lot to train multi-level bridge engineering talents based on the system of registered engineers and engineering ability.

Keywords: Bridge engineering; teaching reform; engineering application.

1. Introduction

Bridge Engineering is an important professional course in the field of civil engineering. It is also a course with strong practical application. It includes planning, survey, design, construction and other links. Along with the rapid development of the national economy, the bridge construction technology is changing with each passing day, the traditional teaching system of Bridge Engineering urgently needs to be revised to adapt to the discipline development of bridge engineering under the new situation, and to meet the social requirements for professional and technical personnel of bridge engineering. This paper starts from the current teaching situation of Bridge Engineering course in our university, and then puts forward the reform ideas combined with the actual situation.

2. Teaching Status of Bridge Engineering Course

Bridge engineering has a prominent position in the cultivation of civil engineering professionals, so it determines the importance of its teaching, but in just a few years of teaching career, I found that the following problems exist in the teaching of bridge engineering courses:

(1) There are few courses to study, and the theoretical content of the course is strong, but its practicability is weak; the theoretical teaching of Bridge Engineering still focuses on teaching, involving many types of bridges, and each type of bridge involves related concepts, structural requirements, calculation, normative provisions, etc. The contents are more, but the class hours are less, and the knowledge points are fragmentary [1-2]. It is difficult for students to master the theory without engineering practice.

(2) The teaching method is single and students lack interest in learning.

(3) Formalization of practical teaching: the practical teaching of Bridge Engineering mainly includes two parts: actual production internship and curriculum design. The first part is mainly based on static visits due to the short internship time. Due to the long construction period of the bridge project, the internship can only understand some of the projects or a certain process, and cannot fully understand the entire construction process, and cannot participate in the bridge construction. Students generally reflect that the theoretical knowledge they have learned cannot be applied in production internships, and there is no clear understanding of the whole process of bridge construction. In the latter part of the course design, due to the limitation of hand calculation, the bridge type can only be a simple supported beam bridge, which obviously lags far behind the needs of bridge construction development.

(4) Course assessment can't accurately reflect students' ability and can't effectively promote students' self-learning.

(5) Most of the teachers in the Department of Highway and Bridge in our university are young with high educational background. They basically go from one college to another, with a strong theoretical foundation, but lack of practical exercise and poor hands-on ability. In addition to the "re-scientific research, light application" in colleges and universities, teachers do not pay attention to engineering practice.

In view of the above problems, and in order to meet the training requirements of talents in the new situation, the bridge project needs to be comprehensively reformed.

3. Teaching Reform Measures of Bridge Engineering Course

According to the teaching status of Bridge Engineering course, combined with the actual situation of our school, several teaching reform measures of Bridge Engineering are proposed.

3.1 Develop a New Syllabus.

The bridge project includes four parts: superstructure construction and design, structural calculation, bridge construction and substructure design. Therefore, the main line should be grasped when giving lectures. Select a basic bridge type, through the upper structure design calculation theory knowledge, structural requirements, substructure design theory and common construction methods and specific structural design case analysis, so that students master the entire design process.

3.2 Teaching Method of "Board book + Multimedia"

Practice has shown that the theoretical and practical course of Bridge Engineering is difficult for students to concentrate for a long time. In addition to the blackboard, multimedia teaching is essential, and classroom interaction can be enhanced during classroom teaching to improve students' Learning interest.

Multimedia teaching mainly USES pictures and animations. In particular, when explaining bridge construction, construction points and details can be explained one by one through a series of actual pictures. At last, the key points of construction are all connected through the construction animation, which directly shows the whole coherent construction process.

3.3 Introduction of Engineering Case

The engineering case can be the design and construction of various types of typical bridges, and can also be combined with current events, such as the collapse of bridges in recent years or the latest developments in bridge construction at home and abroad. It can also analyze the engineering cases of the registered engineer exams, show the relationship between various types of different bridge types in the case project, deepen the students' understanding of the basic theories of various bridge systems, and Let the student connect some fragmentary knowledge points together. Motivating students to learn and explore, teacher-student interaction is strengthened, and students' learning enthusiasm is also improved.

3.4 Strengthen the Practice Reaching Link

The visiting practice in the practical teaching of bridge engineering is very important for students to strengthen their understanding of bridge structure, design theory and construction points. Our school actively builds and contacts stable internship cooperation base, which not only ensures the continuity of student internship but also guarantees the quality of internship [3].

3.5 Pay Attention to Curriculum Design and Compile Perfect Curriculum Design Guidebook According to New Norms

For many years, the design of our students' courses has been carried out 2 weeks before the test. The time is tight and the tasks are heavy. Many students imitate stereotypically and do not understand

the concrete principles, and the examples in the textbooks are not detailed enough. The curriculum design is a prelude to graduation design. If the course design is not familiar, the graduation design stage will be very difficult [4]. Therefore, in order to effectively promote the progress of students and answer questions in a timely manner, the curriculum design is focused twice a week and the time is answered flexibly. At the same time, the author has compiled the curriculum design instruction of prestressed concrete simply supported slab bridge, prestressed concrete simply supported t-beam bridge, prestressed concrete small box girder and prestressed concrete continuous rigid structure, each of which has devoted a lot of efforts, and has provided effective guidance for the design of students' courses and even graduation.

3.6 Strengthen the Ability to Identify Drawings

For engineering students, looking at pictures is a basic skill. Let students learn the theoretical knowledge and combine the drawings to understand the construction and construction of the bridge. Our department has purchased standard maps of highway bridges, including slab bridges, T-beams, small box beams, etc. At the same time, I have collected a lot of actual bridge construction drawings, and under the premise of not causing copyright disputes, I will take out the class alone to guide the students to study the construction drawings carefully.

3.7 Introduce the History and Culture of the Bridge into the Classroom

Practice has shown that the introduction of bridge history, culture, aesthetics and other aspects of knowledge into the classroom is a good way to stimulate the classroom atmosphere and stimulate students' interest in learning

China is the father of the arch bridge. The famous stone arch bridge Zhaozhou Bridge was built in 605 AD. It has more than 1,400 years of history and is still intact. It is well-known all over the world and is known as the "International Civil Engineering Milestone Building". Europe emerged in the mid-19th century, more than 1200 years later than China.

The Qiantang River Bridge was built by Mr. Mao Yisheng, the pioneer of China's bridges. It is the first railway-highway combined bridge designed and built independently in China. It was opened to traffic in September 1937. In December of the same year, the Japanese army invaded China and captured Hangzhou. the bridge was destroyed after the Chinese army withdrew to the West and repaired in March 1947. This bridge is the epitome of our national suffering in a specific historical period. It is wrapped in the bones of our nation.

Wuhan Yangtze River Bridge, Nanjing Yangtze River Bridge, Jiujiang Yangtze River Bridge, Wuhu Yangtze River Bridge, Nanjing Dashengguan Yangtze River Bridge and Wuhan Tianxingzhou Yangtze River Bridge are the milestones of China's railways; followed by Chongqing Shibampo Yangtze River Bridge Double Bridge, Chaotianmen Bridge, Lupu Bridge, Sutong Bridge and Xiqiaomen Bridge have set the world's best, and the opening of the Hong Kong-Zhuhai-Macao Bridge has marked the transformation of China from a big bridge country to a bridge power.

3.8 Innovation Ability Expansion

In order to cultivate students' ability to think and solve problems, our department organized some bridge model design competitions, such as bridge software design competition and bridge model production competition. Through the software design competition, students can be familiar with the finite element software commonly used in bridge design, designing the requirements of industry specifications during calculation; through the model making contest, the structure and force of each part of the bridge can be clearly understood, and the teaching content can be better grasped. A better model can continue to participate in the annual structural design competition.

3.9 Industry Norms Infiltrated into Teaching

The registered engineer exam is based on the application and expansion of norms [5]. Therefore, in the undergraduate teaching, the specifications of design calculation, construction and other applications are included in the scope of the lectures, to cultivate students familiar with the norms, to

read the specifications, and to design and construct according to the specifications habit, the "normative consciousness" runs through the whole process of classroom teaching.

3.10 Establishment of Network Teaching Resources

Relying on the existing network resources of the school, relevant teaching resources such as: course introduction, syllabus, electronic teaching materials, electronic lesson plans, exercises and answers, bridge design examples, bridge related specifications, construction atlas, etc., are uploaded to the Internet to facilitate student classes. After learning to download.

At the same time, the learning and answering area of bridge engineering course and Weixin group or QQ group [6] are established to facilitate the interaction between teachers and students. It can also set up famous bridge design, construction units and other related websites at home and abroad to broaden students' horizons, strengthen engineering literacy, enhance the interest of learning and improve teaching effect.

3.11 Reform of Assessment Methods

In order to adapt to the requirements of current quality education, and to cultivate senior civil engineering professionals with high comprehensive quality and the ability to independently think and solve various practical engineering problems to meet the needs of the society. It is necessary to abandon the old single examination paper examination method, which only values scores but despises abilities. I have established a new way of assessment. While emphasizing students' examination results, I also pay attention to the assessment of students' learning process, learning attitude, innovative consciousness, problem solving ability, and strive to make a comprehensive, objective and fair evaluation of students. The performance evaluation of the course "Bridge Engineering" mainly considers the assessment of students' basic knowledge, basic ability and engineering application and innovation ability, as shown in the figure 1.

According to the "Bridge Engineering" score evaluation system, we should change the previous single test paper examination method, and incorporate classroom performance, homework completion, reading reports, course papers and scientific and technological activities into the assessment of normal performance. Among them, classroom performance accounts for 20% of normal performance, homework completion accounts for 30%, reading reports for 20%, course papers for 20%. Science and technology activities accounted for 10%. The final score of the course is composed of the usual score (60%) and the theoretical test score (40%).

4. Conclusion

The engineering application-oriented teaching of Bridge Engineering course has corrected the phenomenon of "heavy theory and light practice" in the past. According to the preliminary effect of implementing reform in the past three years, the reform program has been recognized by professional scholars and students. Has achieved certain results, improved the status quo of teaching to a certain extent, and gradually formed an application-oriented talent training model that meets the needs of industry development.

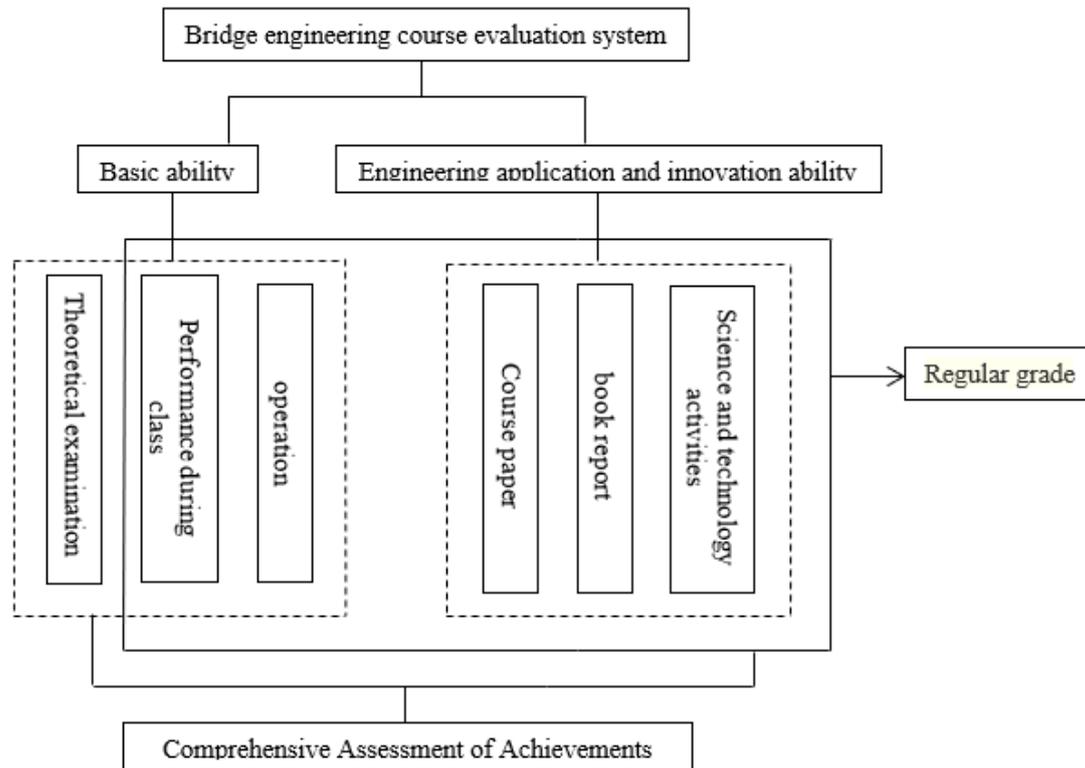


Fig 1. Bridge engineering course assessment method

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