

# *Case-Based Teaching Reform of Building Construction Technology*

**Kai Guo**

*School of Civil Engineering, Shenyang Jianzhu University, Hunnan Road, Shenyang, China*

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**Abstract:** Given the characteristics that the basic theoretical knowledge of engineering undergraduates in colleges and universities is relatively weak and lacks complete case teaching, this paper proposes the teaching methods of case teaching and inquiry teaching, using actual engineering cases as the design content of the introduction and post. To develop students' thinking and capacity to understand fundamental theoretical information and solve practical issues, so that engineering students' theoretical knowledge and engineering practice become one. Enhance pupils' professional abilities while also shaping their sense of social responsibility.

## **1. Introduction**

The course in building construction technology is a required main course for civil engineering students. Engineering mechanics, concrete design principles, steel structure design concepts, engineering geology and hydrogeology, and other fundamental disciplines are covered in the course. It is a course with a high level of application and practicality[1]. Professor Keener of Harvard University pioneered the Case Teaching Method in American law education in 1890, and it quickly spread to management, economics, and medical education. Case teaching is a teaching approach in which teachers choose and employ a specific case based on classroom teaching objectives and teaching content[2]. The essential assumption for implementing the case teaching technique is to create a case base matching to teaching knowledge points, and the case base is mostly based on a large number of literature collection and practical case extraction[3].

In recent years, to improve teaching quality and cultivate students' professional quality and engineering practice ability, many scholars have conducted beneficial exploration and practice on teaching methods and models of construction technology. Ju Yuwen et al.[4] proposed introducing engineering examples, strengthening curriculum design and reforming examination methods in the teaching process. Dai Guozhong et al.[5] proposed the teaching method of intensive teaching and more practice, classroom discussion, case analysis, and audio-visual aids. Wang Yuexiang et al.[6] systematically discussed the teaching contents and methods of the course of foundation and foundation engineering given the characteristics of the course in the direction of architectural engineering, and proposed that the teaching should be clear in concept, stress on thinking, and focus on the review. Course teaching is the main battlefield of knowledge teaching, ability, and quality training, but the time in the classroom is limited. How to effectively use the time in the classroom is a long-term and arduous task.

## **2. Problems in the Teaching of Building Construction Technology**

### **2.1. The Single Traditional Teaching Method Can Not Give Full Play to the Students' Initiative**

Paul Ferreira, a famous contemporary educator, once pointed out various drawbacks of "lecture-based teaching", which is a teaching method that takes teachers as the center, teachers teach, students are taught, teachers think, and students are thought. The result can only be that teachers make choices and impose them on students, while students obey orders. Finally, teachers regard themselves as the opposite of students' freedom and confuse the established professional authority with the knowledge authority[7].The advantage of lecture teaching is to give play to teachers' educational functions, which is conducive to imparting systematic knowledge, enhancing teaching efficiency, and controlling the teaching process. The teaching content of the course on construction technology is complex and covers a wide range of knowledge, so other methods cannot replace the dominant position of lecture teaching in the main teaching. However, the retention rate of learning content obtained passively through listening is extremely low.

### **2.2. More Teaching Content and Less Teaching Hours**

With the continuous development of disciplines and engineering technology, new theories, new methods, and new processes in the field of building construction is emerging. To meet the needs of talent cultivation of "broadening the professional caliber", the teaching content of building construction is also increasing. However, with the implementation of educational reform in colleges and universities, the teaching hours of various courses are being compressed. At present, the class hours of civil engineering construction technology in the 2021 edition of the training plan for the civil engineering major of Shenyang University of Architecture and Construction are only 48 class hours. The teaching of the basic content of the course is very tight. The phenomenon of "full room" is common. The boring classroom has seriously affected the students' learning enthusiasm and knowledge mastery.

### **2.3. Classroom Teaching is Seriously Disconnected from Engineering Practice**

Civil engineering construction technology is a course with strong practicality and application. Only when it is closely related to engineering practice can it be taught and learned well. This requires that on the one hand, teachers should not only have solid theoretical knowledge, but also have the strong practical experience to achieve the combination of theory and practice; On the other hand, students should not only rely on imagination in the learning process but should let students more contact with the engineering practice and integrate the knowledge learned into the engineering practice. However, due to the limitations of on-site conditions and class hours, the practice part of the course teaching process is less involved. Students often feel that the course content is abstract and difficult to understand and master. After learning, they cannot use the knowledge they have learned to solve practical problems, and students lack a sense of achievement and enthusiasm for learning.

### **2.4. Many Students Do Not Have a Strong Sense of Initiative and Innovation**

According to the author's survey, most undergraduate students in school have relatively low innovation ability, lack innovation desire and innovation awareness[8],cannot integrate book knowledge and professional skills, and lack the ability of self-active learning awareness and active

thinking. To meet the needs of the job, most students choose to spend a lot of spare time on obtaining more grade certificates, accepting all the knowledge in the reference materials without selection and doubt, and reciting the so-called "standard answers". Although most students passed the exam, they did not understand the content of the exam. The act of "rote memorization" also subconsciously implied that students could pass the exam as long as they remembered well. Therefore, it has caused the social status quo that students' innovative consciousness and ability are not strong, and their innovative motivation and passion are lacking.

### **3. Advantages of Case Teaching In Building Construction Technology Course**

The so-called case teaching is not an example analysis conducted by teachers to illustrate certain theories or concepts in classroom teaching, but an open and interactive new teaching method[9]. The case teaching method originated in the United States at the beginning of the 20th century, which is a unique teaching method. Help, cultivate, and develop students to actively participate in class discussions and think positively through the real situations or events of images. The case teaching method is suitable for developing advanced intellectual skills such as analysis, synthesis, and evaluation ability. These skills are just necessary for professional construction technicians. The scene reproduction of the construction site can provide students with cases, and help them prepare and discuss cases and analyze results. Communication through group discussion can help students improve their participation in learning, and the effectiveness of case analysis can directly reflect the learning effect of students. The uniqueness of construction projects determines that every employee is solving a new problem when facing specific projects. Especially for construction technology, even if the "Great Harmony" has "Minor Differences", educators must cultivate students' ability to think independently and explore independently.

The construction technology of civil engineering covers earthwork, foundation engineering, masonry engineering, concrete engineering, prestressed concrete engineering, hoisting engineering, etc. The background of the project is rich. Only by combining actual engineering cases can the relevant knowledge be vivid and vivid, and student's enthusiasm for learning and interest in the major be aroused. Case teaching is a heuristic teaching method. It can build a bridge between the theoretical teaching of construction technology and engineering practice, which not only enriches students' theoretical knowledge but also enhances students' engineering practice ability. It will make a good connection between the subsequent curriculum design and graduation design, and lay a solid foundation for future work. Teachers must devote themselves to exploring the case teaching reform of the course of foundation and basic engineering.

### **4. Case Teaching Reform of Building Construction Technology Course**

Generally speaking, case teaching should go through careful planning and preparation in advance, guide students to read cases in advance, organize students to discuss, and form repeated interaction and communication. At the same time, case teaching should also be combined with theoretical teaching to enlighten theory and inspire thinking through the collision of various information, knowledge, experience, and views. To better complete the teaching task of the foundation and foundation engineering course, the case teaching of the building construction technology course should pay attention to the following aspects:

#### **4.1. Construction of Course Teaching Case Base**

To make the case teaching method smoothly carried out in the teaching of building construction technology courses, it is necessary to collect, sort out, and design representative and typical

engineering cases through literature retrieval and field research. According to the actual needs of the college's undergraduate training program and project, the teaching case library of foundation and basic engineering courses is built around three types of classroom teaching cases, extracurricular discussion cases, and self-practice cases (as shown in Figure 1). The selection and design of cases should follow the principles of authenticity, standardization, advancement, and practicality[10]. At the same time, the teaching content should be integrated into the cases, and the selection and design of cases should be done well.

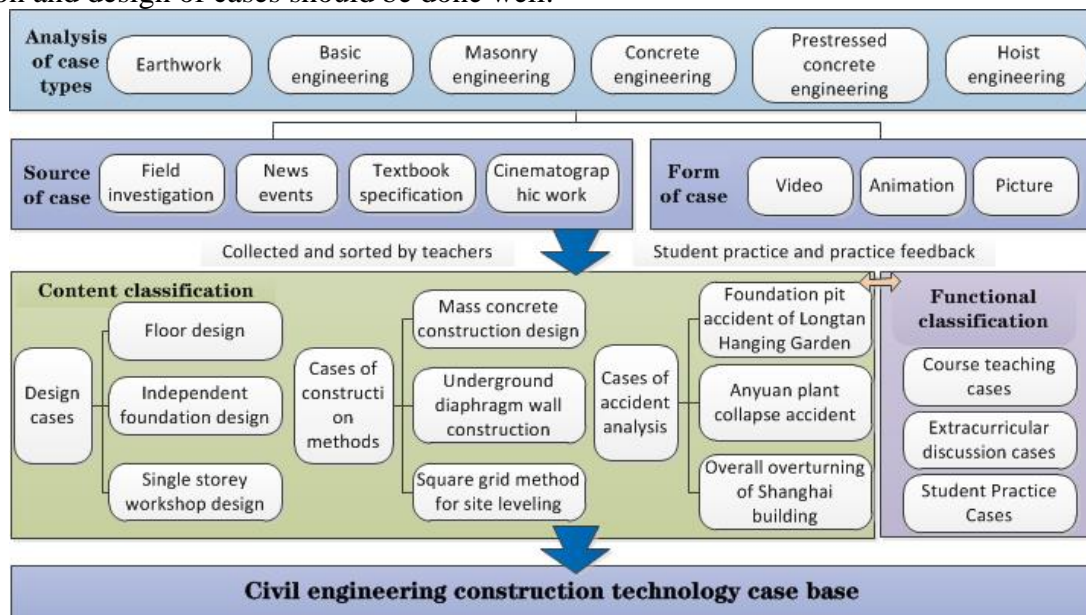


Figure 1: Framework of teaching case base of foundation and foundation engineering course

As shown in Figure 1, in the construction of the actual case base, teachers should choose case teaching according to the key and difficult contents of the course teaching, such as the foundation engineering slope support learning, the foundation pit stability, and other contents, and the famous "Shanghai Building Falls to the Event" as the starting point; The curriculum design cases of relevant industries are supplemented according to the characteristics of different projects, such as "Anyuan plant collapse event". For foundation engineering, such as rigid foundations, flexible foundations, various forms of shallow foundations, and other cases; Set up pile foundations, open caisson foundations, pier foundation design, and checking calculation cases for students majoring in traffic civil engineering.

#### 4.2. Research on Case Teaching Method

Based on absorbing and drawing on the case teaching methods and experiences of relevant majors and teachers in well-known universities at home and abroad, the case teaching process is designed and organized reasonably and meticulously. According to the teaching content and students' characteristics, the discussion method, questioning method, and prompting method are integrated into the teaching process. Through the introduction of cases, case analysis and discussion, induction and summary, exercises, and other links, students' thinking is fully mobilized, and student's ability to analyze problems from different perspectives is cultivated to achieve the goal of case teaching.

Different teaching contents, cases, and students should have different teaching methods. First of all, according to different types of cases, they are used by students before, during, and after classroom teaching. Cases are arranged in advance to guide students to understand the teaching

content and enter classroom teaching with questions. Secondly, in classroom teaching, the explanation of basic concepts, methods, and other knowledge points, guides students to analyze and discuss the cases, and understand the key and difficult points of teaching after theory and practice. Finally, class time is limited. Through the cultivation of students' interest in learning and the mobilization of their learning initiative, students are required to learn self-practice cases and discussion cases after class. On the one hand, students' ability to solve problems independently is trained; on the other hand, students' ability to communicate and cooperate is improved by completing major tasks in groups, and finally, they master the ideas and methods to correctly analyze and solve problems.

#### **4.3. Case Teaching Practice the Effective Integration of Case Teaching and Current Curriculum Conditions is The Difficulty of Case Teaching Method.**

In practice, the author first used part of the class hours to explore case teaching practice, set up seminars, commented on typical design and engineering accident cases, and fully discussed and communicated with students. For students from different majors, we arranged extracurricular discussion cases related to the majors in groups and set up group defense links to fully affirm the students' new ideas. Classroom discussion, group defense, and other links are included in the course evaluation, a learning process assessment is implemented, and students' comprehensive ability and innovation abilities are examined. According to the students' learning effect and feedback, further improve the teaching form, teaching plan, and assessment method of case teaching. For a mature teaching case library, establish a case teaching resource platform based on web technology or MOOCs to achieve the integration and sharing of teaching resources. On these platforms, students can not only communicate with teachers and other learners but also review and consolidate what they have learned to improve learning efficiency and quality.

### **5. Implementation Effect of Case Teaching Reform**

Based on the research of the curriculum reform project "Exploration and Practice of Case-based and Inquiry-based Teaching Methods of Building Construction Technology", the author conducted a practical exploration of case-based teaching when teaching the civil engineering construction technology course to the students of 2018 and 2019. The teaching design or discussion cases set for the follow-up curriculum design and graduation design make students no longer "confused" about the design issues, and know where to start to look for data and find norms; The construction process and method cases composed of construction site videos and construction machinery pictures have increased the students' perceptual knowledge of the actual project. When organizing summer internships, students are no longer unfamiliar with "grooving machine" and "mud pit"; in the seminar, although the students were a little shy at the beginning, they were still competing to speak when the bell rang. Through case teaching practice, some cases and classroom organization forms have been recognized by the participating students, and students become more confident when facing the follow-up curriculum design and practice site.

### **6. Conclusion**

Through the implementation of one semester of teaching, the learning atmosphere of the teaching reform class has been significantly improved, the students' mastery of knowledge has also been improved, and the students' abilities of self-expression, teamwork, and independent learning have also been greatly improved. And through the reform of effective teaching, it is found that some students who do not love learning and do not do homework take the initiative to participate in

learning, and some students who are eager to learn can actively help other students. The students also have a strong interest in this course, and they also prefer this teaching method from the initial resistance to the latter.

The cultivation of innovation ability is a long process, and the study of one course alone cannot completely solve the current situation of the lack of innovation ability of graduate students. However, through the teaching reform of Civil Engineering Construction Technology, students will abandon the traditional bad learning habits such as "rote learning" and "temporary cramming", and constantly adapt to new teaching methods and actively discuss and communicate in the classroom. Think and show yourself to others. The discussion teaching reform provides a platform for students, where graduate students can continuously improve their ability to think, discuss and solve problems independently, thus improving their innovative awareness and thinking, and laying a solid foundation for students in the next project practice.

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