Research on Teaching Reform of Civil Engineering Construction Course under the Background of New Engineering

Chonggen Pan 1*, Keyu Chen 1, 2, Xinyuan Shen 1
1 Ningbo institute of Technology, Zhejiang University, Ningbo 315100, China;
2 School of Civil Engineering and Architecture, Zhejiang Sci-tech University, Hangzhou, 300018, China
Email: panchonggen@nit.zju.edu.cn

Abstract: "New Engineering" is an engineering education reform carried out in China under the background of a new round of industrial technology revolution, which puts forward higher requirements for students' engineering practical ability and innovative thinking. Civil engineering construction course is one of the important required modules for civil engineering majors, which has the characteristics of complex course content, lack of connection between chapters, and less practical knowledge. The traditional teaching model cannot effectively adapt to the curriculum, leading students to lack of practical ability, interest and other problems. Starting with the educational concept of "New Engineering", this paper analyzes the problems in the current teaching process of civil engineering construction course, and puts forward the corresponding teaching reform measures to provide reference.

1. Introduction
China has the largest engineering education in the world. According to the Statistics of the Development of Education in China in 2019 by the Department of Development and Planning of the Ministry of Education, by the end of 2018, there were 2663 ordinary colleges and universities in China, of which more than 90% offered engineering majors. Among them, there are 5.7 million engineering undergraduates and 1.37 million current graduates. Engineering students account for approximately one third of the total number of students in higher education [1], highlighting that the social and economic development of China is inseparable from engineering science and technology, and also confirming the importance of engineering talents training at the present stage [2-3].

In 2017, the Ministry of Education issued the circular on carrying out New Engineering Research and practice, whose main connotation is the application of new technologies and the cross-integration of multi-disciplines. The main contents include the new concept of engineering education, the new structure of disciplines, the new mode of personnel training, the new quality of teaching [4-5]. The biggest difference between the "new engineering" and the traditional one is that it pays more attention to the cultivation of students' engineering practice literacy and puts the improvement of students' engineering design and analysis ability in priority [6]. This new model aims to further strengthen the global vision, engineering thinking and innovative practical ability of engineering students, and open up a new path for the reform of engineering education in China [7-8]. Civil engineering major is one of the representatives of traditional engineering specialty. The traditional teaching mode of professional courses is facing a great challenge in the new round of scientific and technological
revolution, and industrial revolution. It further leads to a series of problems such as low quality of graduation design, lack of practical ability [9]. Therefore, it is imperative to cultivate a group of diversified and innovative high-quality civil engineering talents who can meet the training requirements of "new engineering"[10]. Based on the educational concept of "new engineering", many domestic scholars have carried out teaching reforms in many civil engineering disciplines, such as material mechanics [11], structural mechanics [12], soil mechanics [13], and significant results have been achieved so far.

In the undergraduate course system of civil engineering specialty, civil engineering construction course is an important professional basic course, which summarizes the construction technology of all kinds of projects and mainly studies construction technology and construction organization [14-15]. At the same time, the course involves mechanics, concrete structure, building materials, soil mechanics and basic engineering, management and other basic course knowledge, with a strong comprehensive and practical. The traditional teaching mode has some disadvantages, including poor teaching effect, the dissatisfaction of rapid changes of the technological requirement, and unachievable training goal of "new engineering". Therefore, based on the teaching background of Zhejiang University Ningbo Institute of Technology, the author combs the problems existing in the civil engineering construction course at the present stage and further puts forward the teaching reform measures to meet the training requirements of "new engineering".

2. The problems existing in the conventional teaching scheme
Teaching is a magnificent link for students to fully master theoretical knowledge, cultivate application ability as well as innovative consciousness, which is also the only way to realize the talent training of "new engineering" [16]. The author now analyzes the problems in the teaching stage of civil engineering construction course.

2.1 There is a lot of teaching content, and the students are not interested enough
Taking the textbook "Civil Engineering Construction" [17] published by China Construction Industry Publishing House used by Zhejiang University Ningbo Institute of Technology as an example, the book includes two parts: construction technology and construction organization. the teaching system of the course and totally eleven chapters including earthwork, pile foundation engineering, masonry engineering, concrete structure engineering, road engineering and bridge engineering, while construction technology and construction organization include five chapters such as flow construction and network planning [18]. It also involves a number of professional courses, the content is complex, involving a wide range of areas, resulting in further increased difficulties for students to learn.

On the other hand, each chapter of civil engineering construction is organized according to the order of engineering construction, and each chapter only introduces the construction technology and construction methods of specific types of work. Taking the concrete structure engineering as an example, this chapter only introduces the formwork support, steel bar processing and concrete transportation and pouring trees needed for construction. The different chapters are almost independent of each other [19]. The part of construction organization spans the two disciplines of technology and system management, and has great differences. The high comprehensiveness of civil engineering construction and the span of knowledge system lead to students' difficulties in learning, make students bored in the process of learning, and affect the teaching effect of civil engineering construction courses to a certain extent. It is difficult to meet the training requirements of "new engineering" for students.

2.2 The effect of teaching mode is not good, and the training of practical ability is insufficient
The training content of "New Engineering" emphasizes more on the training of students' practical and innovative ability, where the cultivation of practical ability not only stays in the links such as practice and engineering training but also requires the gradual transmission of practical knowledge to students in the stage of theoretical teaching [20].
At the present stage, the teaching of civil engineering construction generally stays in the segment that professional teachers impart the knowledge via blackboard, PPT or other courseware. Students passively understand the knowledge points such as site leveling and foundation pit slope, and examine them by means of arranging calculation books and so on. Taking the civil engineering students of Grade 2016 of Zhejiang University Ningbo Institute of Technology as an example, professional teachers have arranged a number of course designs, such as reinforced concrete frame structure support formwork design, fastener scaffolding design, single-story industrial factory structure hoisting organization design and so on. Although students can achieve good results and have good theoretical knowledge, their mastery of practical case analysis or practical knowledge of the corresponding engineering is still weak. Therefore, it is difficult to effectively cultivate compound "new engineering" talents with strong engineering practice ability and strong innovation ability.

2.3 The weakness of teachers' engineering practice ability and lack of practice space
The comprehensive quality and practice site of professional teachers play a very important role in the teaching of civil engineering construction course [21]. At present, the professional teachers in Chinese colleges and universities all require high academic qualifications and strong theoretical analysis ability, but relatively low requirements for professional teachers' engineering practice ability [22]. At the same time, the teaching and scientific research tasks of professional teachers are also relatively heavy, making it difficult to get in touch with specific engineering projects. The practice site is the basis of training students' practical ability, and the necessary practice site can meet the needs of "new engineering" education. The engineering practice ability of professional teachers and the venue have indeed become two important reasons that restrict the training of students under the requirements of "new engineering".

As a course with more practical knowledge, civil engineering construction has more than 40 key points of engineering operation only in the part of civil engineering construction technology, which has higher requirements for professional teachers' engineering practice ability and practice site. At present, domestic colleges and universities pay more attention to theoretical teaching and carry out "spoon-feeding" teaching for students. Only taking the earthwork chapter as an example, professional teachers introduce the relevant knowledge of site leveling and bulldozers, excavators and other corresponding mechanical equipment, but mostly stay in the use of text description or picture display stage. On the other hand, taking the school of architectural engineering as an example, there are many large laboratories, such as geotechnical and road engineering laboratory, structure and bridge laboratory, with a total area of more than 6,000 square meters. However, most of them are mainly operating scientific research projects, so it is difficult to get in touch with the real civil engineering construction links.

3. Reform measures of Civil Engineering Construction course
At present, there are some problems in civil engineering construction, such as jumbled teaching contents, less practical knowledge, lack of site and teachers' engineering experience, which seriously restrict the training of professionals to adapt to "new engineering".

3.1 Optimize the teaching contents and means to stimulate students' interest
On the basis of the traditional teaching methods, professional teachers should optimize the teaching contents and means. First of all, the teaching content of civil engineering construction should be screened according to the professional direction of the students. Simultaneously, the teaching content should be expanded following the new construction technology and construction materials in the teaching process, so as to widen the students' field of vision and lay the foundation for the training goal of "new engineering".

Teachers should also constantly improve the teaching methods in the process of teaching cause the conventional teaching methods only explain the relevant principles and examples in a limited time. Teachers should timely adjust the traditional teaching mode of “taking teachers as the main body of the
classroom’ and regard multimedia teaching as a useful supplement to traditional teaching. It can be a good practice to stimulate students' interest by introducing the latest engineering cases. Moreover, it is beneficial for a better elevation and development of students via joining the link of student report. Teachers can divide the students into several study groups and conduct case studies or new process introduction reports before each lecture. Further improve students' interest in autonomous learning and the ability of engineering case analysis to meet the training requirements of “new engineering”. Many domestic scholars have also reformed the classroom teaching of civil engineering construction theory by selecting new teaching materials, compiling learning handouts in advance, adjusting class hours, and further improved the classroom efficiency.

3.2 Improve the practical level of teachers and build a team of double-qualified teachers

The "new engineering" policy puts forward higher requirements for students' engineering practice ability while the traditional theoretical teaching restricts students' development. Therefore, it puts forward higher requirements for professional teachers' engineering practice level. In view of the civil engineering construction course, Zhejiang University Ningbo Institute of Technology gives priority to selecting teachers with rich engineering experience in their teaching group, and actively encourages teachers to go to the campus practice site or off-campus practice base regularly or irregularly to study, personally experience specific construction, supervision, design links, and increase the ability of engineering practice. At present, the assessment mechanism of teachers in many Chinese colleges and universities is mostly focused on teaching tasks and scientific research workload, and there are few requirements for teachers' practical ability. The school will further encourage teachers to cooperate with enterprises to apply for topics, jointly carry out research on new technologies and new technologies, and guide some students who are interested in college students' scientific research to participate in teachers' scientific research work to achieve the training goals required by "new engineering" and improve students' innovative and practical ability.

Based on the training background of "new engineering" and the rich practice content of civil engineering construction, the construction of "double-qualified" teacher team should be carried out actively. The concept of "double-qualified" teachers was first put forward by vocational education, which is helpful to improve the practical ability of students in higher vocational colleges. Specifically, it refers to the further improvement of the practical ability of teachers in our school and the introduction of enterprise front-line elites to participate in the teaching work. At the school level, a group of engineers with rich practical ability and teaching potential should actively participate in the teaching of civil engineering construction. Front-line construction personnel can introduce specific construction knowledge such as steel bar binding technology and pile driving process to students. Improving students' understanding of civil engineering construction practice courses to meet the training requirements of "new engineering" is also a meaningful approach. Through further cooperation, front-line staff can also participate in the discussion and revision of civil engineering construction course design and final examination questions. By building a "double-qualified" cooperation platform, the school can have an in-depth understanding of what kind of talents enterprises need at the present stage and revise the syllabus in time, taking the needs of enterprises as an important reference and guidance for students' graduation.

4. Conclusion

The course of civil engineering construction is a civil engineering professional course with strong practicality, complex knowledge system and small correlation between chapters. The conventional teaching model, on the one hand, is hard to stimulate students' learning interest and engineering practice ability, and on the other hand, is unable to meet the training requirements of "new engineering" and the needs of employers.

In the modern education and teaching system, how to cultivate students and make full use of their enthusiasm is the focus of this reform. In order to train more "new engineering" professional practical talents, the teaching of civil engineering construction must be reformed from many aspects, such as
optimizing teaching mode, improving teachers' practical level, introducing new technology and so on, targeting to improve the teaching quality of the course and to cultivate excellent civil engineering professionals for China's socialist capital construction. Zhejiang University Ningbo Institute of Technology has also carried out teaching reform on the course of civil engineering construction based on the above teaching reform measures, and the students' professional practical ability and achievements have been significantly improved, which verifies the feasibility of the above theory.

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