

Current Situation and Mode Construction of Mixed Teaching in Civil Engineering Materials Course

Huadong Sun, Yongling Ding*

School of Transportation Civil Engineering, Shandong Jiaotong University, Jinan, China

**Corresponding author*

Abstract: *Mixed teaching is a new teaching mode derived from the new educational concept, which has been widely used in various disciplines and has achieved very good teaching results. Among civil engineering majors, the course of civil engineering materials is a basic course as well as a compulsory course for students. The knowledge points of civil engineering materials course are more complex, and more attention is paid to narration in the teaching process. Based on this, this paper takes the civil engineering materials course of Shandong Jiaotong University as the research goal, proposes the idea of integrating the mixed teaching method into the civil engineering materials course, carries out teaching practice, reforms from many aspects such as course design, practice and evaluation, and systematically analyzes and compares the teaching effects, aiming to provide reference for the application of mixed teaching in the civil engineering materials course in China.*

Keywords: *civil engineering materials course, mixed teaching, talent cultivation, mode, construction*

1. Introduction

Engineering education accounts for more than 30% of China's higher education system. According to the concept of engineering education certification, technical education is not the only way to cultivate engineering talents[1]. It requires graduates to have the ability to analyze and solve specific engineering problems on the basis of mastering basic engineering knowledge, and also requires students to have other knowledge and abilities, such as understanding the sustainable, green and low-carbon, environmental protection, economic and other properties of civil engineering materials, and can design and select materials according to the characteristics of the project. How to cultivate compound engineering talents with engineering practice ability and scientific research innovation ability in the campus and classroom, and how to reform and innovate the traditional teaching process according to the engineering education certification concept are the major challenges facing the current higher engineering education. The course of civil engineering materials experiment exercises and improves students' comprehensive ability through a series of processes, such as scheme design, experiment operation, result processing, phenomenon analysis, and experiment conclusion. However, at this stage, there are a series of problems in the teaching process of civil engineering materials experiment course, such as the lack of close connection between the experimental content and the actual project, the lack of innovation in teaching methods, which cannot meet the relevant requirements of the engineering education certification concept. In order to better adapt the wood engineering specialty to the scientific and technological change and industrial upgrading in the new era, it is necessary to further reform and innovate its teaching process, teaching methods and teaching mode in combination with the engineering education certification concept, and transform the teaching and training mode from training professional talents with strong professional theoretical knowledge to training compound professional talents with high comprehensive quality, such as good communication ability, innovation and practice ability.

The concept of mixed teaching was first proposed by foreign training institutions. This new teaching mode is to integrate online and offline teaching. Professor He first introduced this teaching concept and integrated it into domestic teaching[2]. The hybrid teaching method can well combine the network teaching and traditional teaching, and give full play to the advantages of both. It not only highlights the dominant position of students, but also guarantees the leading role of teachers in the teaching process[3]. Therefore, this teaching method has also become the main object of inquiry for current educators in China. This paper deeply analyzes and explores the application of the hybrid teaching method in the teaching of civil engineering materials in Shandong Jiaotong University, hoping

to provide reference for the future curriculum reform of colleges and universities in China.

2. Teaching status of civil engineering materials

2.1 Decentralized teaching content

From the current setting of teaching content of civil engineering materials in colleges and universities in China, there are problems such as relatively dispersed teaching content, lack of connectivity and logic between knowledge points, complex teaching content, and difficulties in teaching and learning. In addition, the range of knowledge points involved in the course of civil engineering materials is wide, which is characterized by fragmentation and lack of coherence between chapters, students often need to spend more time and energy in the learning process. When designing teaching content, teachers also pay more attention to theory, which leads to less connection between it and real life. Only students with certain practical ability can well master the teaching content of this subject. The dispersion of teaching content leads to the improvement of teaching difficulty, and the teaching effect can't meet the expectations.

2.2 The main position of students is not obvious

It can be seen from the interview and investigation that the traditional teaching mode is still applied in the teaching of civil engineering materials in most colleges and universities in China [4]. In the classroom, teachers devote more energy and time to the explanation of theoretical knowledge, students are more passive in acquiring knowledge, and there is a lack of interaction between teachers and students. And the practice content and practice class are arranged less. Even if the practice class is arranged, it is mainly a confirmatory experiment, which is demonstrated by teachers and observed by students. However, the experiment effect is often poor. This teaching mode will not only affect students' learning enthusiasm and teaching effect, but also ignore the dominant position that students should occupy in the learning process, passive learning is not conducive to the improvement of students' learning ability.

2.3 Single teaching evaluation method

The evaluation of teachers' teaching ability and students' learning ability is the main content of teaching work, which is directly related to the level of teaching quality. However, from the perspective of the current teaching situation of civil engineering materials courses, most colleges and universities only have final examinations for teaching evaluation, and the methods and standards are relatively simple. This one-sided teaching evaluation method makes both teachers and students pay more attention to the study of theoretical knowledge in daily teaching, only care about the final learning effect, and neglect the cultivation of practical ability in the learning process. Moreover, the evaluation method aiming at examination can only make a one-sided evaluation of students' ability, and the measurement of teaching effect is not comprehensive enough. Teachers can't accurately grasp students' learning situation, and it is not conducive to the setting of teaching objectives and teaching content.

2.4 Outdated teaching system

At present, most of the textbooks used in the teaching of civil engineering materials in colleges and universities in China are aimed at building engineering, and the materials used in civil engineering, subgrade, tunnel engineering and other aspects are less involved. With the rapid development of social economy, China has invested more and more resources in infrastructure construction, and the construction industry has increasingly high requirements on the ability of practitioners. However, the range of materials that students are exposed to during school is not wide enough, which makes them lack corresponding ability in the future practical work, and does not match the actual needs. Most students majoring in civil engineering materials have the problem of insufficient mastery of special materials after work. Although there are some objective reasons for this phenomenon, it is a practical problem in the teaching of civil engineering materials, which requires colleges and teachers to make positive responses.

3. Teaching reform methods of civil engineering materials

3.1 Situational case teaching method

A large number of studies have shown that the application of situational case teaching method in the teaching of civil engineering materials, based on the established learning objectives, can better mobilize students' enthusiasm for learning and let them actively participate in teaching [5]. Therefore, the following is a brief introduction to the situational case teaching method, taking metal materials as an example.

3.1.1 Import Cases

When designing the teaching content, teachers should prepare classic cases in advance and show the teaching content to students in an all-round way with the help of words, pictures, videos and other expressions. You can design a title that will attract students' attention. For example, the title is designed as: Titanic is called the "unsinkable ship", but why did it sink on the first voyage? Then teachers can use the way of playing videos to import cases and trigger discussion, which can fully mobilize and stimulate students' interest in learning before class.

3.1.2 Ask questions

When teachers ask questions, they play a guiding role rather than an active role. After importing the case, the teacher can ask the students to answer the questions. And the problems should be designed reasonably and have certain relevance with the imported case, for example, what are the technical reasons for the sinking of the giant ship; why such a strong ship will cause the huge ship to sink after collision; which material has stronger impact toughness.

3.1.3 Clarify teaching objectives

With OBE teaching concept as the standard, students' expected learning achievements and learning directions should be determined before teaching. If students' interest and enthusiasm in learning have been fully mobilized after introducing cases and raising questions, teachers can naturally throw out the learning objectives, and the learning objectives can be set at multiple levels. Take fireproof materials as an example. The teaching objectives can be set as follows: ① Grasp the reasons why steel components are easy to collapse in case of fire; ② Basic knowledge of steel fire prevention principles and fire prevention measures commonly used in civil engineering; ③ Grasp the influence of reinforcement and section steel protective layer on the fire resistance of steel members; ④ Starting from the temperature change curve of steel under impact, the causes of brittle fracture of steel are analyzed.

3.1.4 Teachers' teaching and students' participatory learning

Teachers focus on teaching objectives, combine the previous introduction cases and concepts and knowledge points introduced in the textbooks to teach. For example, the fire resistance of civil engineering materials, fire resistance of components, DBTT, etc. are the main knowledge points. In the process of teaching, we should focus on highlighting the dominant position of students, create a relatively relaxed and pleasant learning environment for students with reasonable teaching strategies, and pay attention to the interaction between teachers and students and the communication and discussion between students in the teaching process to ensure that the teaching objectives can be achieved.

3.1.5 Teaching summary

In the last 10 minutes of each class, the teacher should summarize the teaching content and relevant questions of this class, and ask targeted questions again. For example, when a fire occurs in a building, the internal temperature is bound to rise. What changes will happen to the mechanical properties and deformation properties of steel at this time? What are the principles and measures for steel to prevent fire when a fire occurs; which chemical elements can be added into steel to optimize the low temperature brittleness of steels. In addition, teachers can also sort out the metal materials explained in the course by summarizing, so that students can learn relevant knowledge more systematically.

3.1.6 Extension and expansion

In situational case teaching, students' participation is high, their interest in learning is fully mobilized, and the classroom atmosphere is active. Teachers can make full use of this learning atmosphere, give proper guidance to students, and extend and expand their knowledge points, such as teaching students how to use the knowledge learned in the civil engineering materials course to solve

problems in real life, they can also arrange homework for students to practice and explore in groups. The content of the topic can be set as: how to escape more safely and quickly in case of fire; how to apply low temperature brittleness of materials to life.

3.2 Modularization of teaching content

When designing the teaching content, we should pay attention to the consistency between the contents, so that it has the characteristics of modularization, and should focus on the engineering application, with a certain frontier. Under the constant promotion of teaching reform, its teaching focus has changed from the previous focus on examination to focus on application [6]. Therefore, in recent years, various colleges and universities in China have made adjustments in the class hours of geotechnical engineering materials, showing a gradually decreasing state. And the class hour structure has also changed, and the practice teaching class hours have increased. In fixed class hours, arrange as many practical training courses for students as possible to ensure the teaching quality, which is also beneficial to promoting students' initiative. Teachers need to pay attention to the students' mastery of the teaching content at all times, and adjust and improve the teaching content and methods in a timely manner. For example, we can start from the actual needs of the work, reduce the attention on material production, and spend more time on the study of materials in civil engineering applications. At the same time, pay attention to the connection between the current learning content and the subsequent professional courses. Let students fully realize and understand the importance of the civil engineering materials course and its practicability in the future. In addition, the modularization of teaching content is also reflected in the timeliness of content. Teachers should introduce relevant learning research and the latest development achievements of this course into daily teaching. At the moment of advocating low-carbon and environmental protection, teachers can add environmental protection materials and the use of secondary resources in daily teaching. For example, the current residents are more inclined to choose green energy-saving buildings and prefabricated buildings. The state also advocates building sponge cities, and how to repair the ecological problems caused by the application of civil engineering materials, strive to ensure that the teaching of civil engineering materials has the characteristics of the times and frontier.

3.3 Strengthen practical teaching

Strengthening practical teaching can better cultivate students' ability in scientific innovation. In order to better meet the requirements of society and enterprises, colleges and universities should make efforts towards innovative talents when training students. Therefore, when training talents, we should strictly abide by the designed talent training program. During college, college students should obtain corresponding innovative practice credits according to the requirements of the talent training program. Some students with surplus energy or strong learning ability can join the scientific research and innovation projects provided by the school. Through hierarchical design, help students with individual differences in learning ability to find their own learning methods. Let students cultivate their professional ability and innovation consciousness in a relatively relaxed and pleasant atmosphere, and teach students in accordance with their aptitude more effectively. Personalized development mode can provide students with space for interdisciplinary development and innovation and entrepreneurship, allowing them to have more diversified and free learning and development opportunities.

Taking the engineering materials training example course of Shandong Jiaotong University as an example, this practice course is designed according to the training plan for innovative talents in civil engineering. This practice course has a practical teaching link, which can improve the students' comprehensive application ability in civil engineering materials. In terms of the division of practical teaching links, it can be divided into comprehensive practice in the school and visiting the construction site outside the school. On the one hand, students can master the technical requirements of basic civil engineering materials in construction, master the ability to inspect and evaluate civil engineering materials, and consolidate theoretical knowledge. On the other hand, the quality of civil engineering materials is directly related to the quality of buildings. Practical teaching can enable students to better understand the impact of engineering materials on the quality of engineering structures, it can better cultivate students' engineering concept. If some colleges and universities are unable to provide laboratories for students due to funding constraints, teachers can organize students to watch experimental videos for teaching, or organize students to visit the construction site through the combination of schools and enterprises.

3.4 Online and offline hybrid teaching

Advanced and scientific teaching methods should be advanced and interactive. With the in-depth promotion of teaching reform, the integration of advanced information technology and teaching is becoming more and more in-depth. Therefore, college teachers should actively guide students in daily teaching, so that students can complete the exploration of teaching content in the personalized chemistry study. In the era of "Internet+", we should make full use of teaching media and strengthen the quality of talent training. The combination of MOOC and classroom teaching can complement their advantages, and the teaching effect will be greatly improved. For the knowledge points that students can master through self-study, teachers can let them use the network to complete their learning after class, which not only solves the problem of insufficient class hours in the past, but also allows teachers to spend more time and energy on explaining difficult knowledge points, and further explain and explore the textbooks. Secondly, we can also use group discussion to let students find and solve problems in mutual communication, break the traditional habitual cognitive model, and let students have the spirit of questioning and innovation, applying online and offline hybrid teaching in teaching, the position of teachers and students in the learning process has slowly developed and changed. Teachers give priority to guidance, and students gradually occupy the dominant position, which also helps students develop the ability to learn independently. But this teaching method also has higher requirements for teachers' teaching ability. Teachers of civil engineering materials course should not only have solid theoretical knowledge, but also have certain practical experience and innovation spirit. They should be good at guiding and inspiring students in the teaching process, creating a better learning environment for students through teaching reflection, and improving the teaching quality.

4. Conclusion

With the development of economy, China's investment in infrastructure has increased year by year. Accordingly, there are new requirements for the ability of talents in this field. Civil engineering materials are important learning contents in civil engineering, and students' mastery of civil engineering materials also directly affects their future work ability. In view of the shortcomings of the current teaching methods of civil engineering materials in colleges and universities in China, which can't meet the current teaching requirements, this paper takes the civil engineering materials course of Shandong Jiaotong University as the research goal, and from the actual situation, proposes the application of situational case teaching method and online offline hybrid teaching method, and improves the existing teaching methods to make them more systematic and advanced. The improved teaching method can provide students with personalized learning space, and the teaching method combining practice with theory can also cultivate students' independent learning ability and innovation ability, so that they can be well recognized by enterprises and society in the future work and become all-round talents.

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