

Research on the Construction of Teaching Case Library of Tunnel and Underground Engineering Theory

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Abstract: Case teaching can not only satisfy the students' theoretical knowledge, but also enhance their practical and operational ability. Therefore, it has become an important way for professional degree graduates to train. Taking the course of "Tunnel and Underground Engineering Theory" as an example, this paper studies and discusses the necessity of case base construction, case base construction and teaching plan, and the case library teaching goal, and summarizes the basic content and process of case base construction. And corresponding implementations. Practice has proved that the construction of the case base helps to enrich the teaching content, open up the students' horizons, enhance students' cognitive depth and practical operation ability, and provides a conditional basis for the country to cultivate high-quality and strong practical ability.

1. Introduction

With the rapid development of science and technology as well as economy, a group of high-quality talents with strong practical ability are urgently needed to inject new impetus into the country's development. In order to meet the needs of talents, China decided to recruit professional degree graduates among all undergraduates in 2009. With solid theoretical foundation, professional degree graduates are deemed as the application-oriented and high-level professionals who meet the requirements of the certain industries or occupations. At present, the training of professional degree graduates in China is developing in an all-round way and the number of students reaches record high. However, the lack of teaching resources for professional degree graduates has become increasingly prominent, leading to that professional degree graduates generally can not grasp in-depth theoretical knowledge and their practical operation ability is weak. To satisfy teaching requirements and achieve teaching objectives, the construction on China Case Center for Professional Degrees Education was officially launched in May 2013 with the support of the Ministry of Education and the Ministry of Finance. This case center began trial operation in 2015. After several years' construction on case library, great progresses have been made in the scale and effect of the case center.

CaseMethod, as a traditional teaching method, has appeared in ancient Greece for more than 2,000 years. However, the case teaching in the present was proposed by Harvard Law School in 1870 and was adopted formally by Harvard Business School in 1921[1]. With the combination of theoretical teaching and a series of practical cases, the case teaching aims to explain the related theories and professional knowledge according to practical cases, and promotes students to analyze and solve practical cases. Numerous cases can be included into a case library. By the usage of case library, the resources can be shared, thus making the teaching form richer and more convenient. At present, many scholars have made relevant studies on the construction of the case library and delivered some theoretical achievements with constructive significance. After studying the construction of the case library for thermal engineering courses in the field of thermal engineering, Zhao Weilin and others put forward the overall design ideas and the relevant knowledge system[2]; Sun Jianyuan et al., Gu Qiaozhen and others proposed the general idea and main content of the case library construction in the perspective of their own professional direction when they studied and researched the construction process and system of the case library, and their researches have provided relevant guidance for the construction of case library[3-4]; Guo Feng and others discussed

the necessity of case library construction and the preconditions of case teaching in a method of modern material analysis, and proposed relevant suggestions.[5] These results provided rich research experience and guidance for the construction of the case library, which contributed to the development of the case library.

As a professional course for professional degree program in civil engineering, Tunnel and Underground Engineering Theory has the characteristics of a comprehensive curriculum, a wide knowledge span, and a strong engineering practice. Therefore, in order to cultivate high-quality applied talents, the course requires to be taught in a way combining the theoretical knowledge and practical engineering. Compared with engineering field learning, case teaching has the characteristics of rich content, high security and strong operability. Thus, it can enable students to deeply understand the analysis process of theory and professional knowledge, deepen students' understanding of practical cases, and guide students to actively think and learn. Therefore, this form of teaching can achieve its purpose of guiding students to link theories with practices and to learn while thinking.

2. Necessity of Case Library Construction

Nowadays, affected by the growth of economy and transportation, the distribution of educational resources has become relatively unbalanced, and lacking of educational resources has become increasingly prominent. At the same time, in contemporary teaching, theoretical teaching accounts for a larger proportion while the proportion of practical teaching is smaller. As a result, this kind of teaching causes students have difficulties in understanding theoretical knowledge as well as lack of corresponding practical ability [6]. A unified platform for case library can be established by case teaching. The teaching mode combining the practical cognition and theoretical learning can be realized by making the practical cases of related majors into teaching cases. The educational resources can be shared after teaching cases are inputted into the case library, providing conditions for the improvement of the balanced development of education. Therefore, the construction on the case library is of great significance and playing an important role.

2.1 Advantage analysis of case teaching

(1) Improving students' cognitive ability

As students spend most of their time in school, they can't have a real observation and feeling on the problems appeared in practical engineering, leading to their cognitive scope and depth are limited to some theoretical knowledge in the books. The case teaching in Tunnel and Underground Engineering Theory, a professional degree course, can combine many practical engineering cases with theoretical knowledge. By using multimedia technology to present students with real construction scenarios and engineering problems, students can broaden their horizons and their cognitive ability and depth to the complex problems of underground engineering can be enhanced.

(2) Improving students' ability to think about questions and to solve problems

Presenting students with real engineering problems and accident scenes, students can be actively guided to think about the causes of engineering problems by combining theoretical knowledge with practical cases. Besides that, students can be guided to connect with the learned theoretical knowledge, thus deepening their understanding and absorbing on theories. The understanding and absorption of theoretical knowledge, in turn, further promote students to make in-depth study and discussion of practical cases so as to enhance their ability to solve problems.

For some appropriate cases, students can be required to perform modeling analysis on the computer. During the modeling process, there are a number of difficult problems. Solving these problems requires students to think about and make choices. The modeling can fully unleash students' learning potential and enable them to solve problems. Coupled with the perceptual knowledge of professional practice, students operate personally according to the analysis of the practical situation in the site. By doing these, students' ability to operate and to solve practical problems in engineering can be significantly improved.

(3) Improving students' communication skills

Case teaching increases students' interests in theoretical knowledge and activates the classroom atmosphere by demonstrating a large number of practical engineering scenes. For cases and technical details that students have great interest in, students can discuss these with each other or with the teacher during the teaching process. In this way, the time of course learning can be extended. Meanwhile, students can improve their communication and exploration skills while deepening their knowledge learning. As a result, professional applied talents with the ability to cooperate, think and operate can be cultivated.

2.2 Analysis for the demand of case teaching

The perfect case library is the basic guarantee for carrying out case teaching. It is also an important material basis for promoting the reform of professional degree postgraduate training mode. In the training of professional degree graduates, students should be focused on. Based on the cases, the theory and practice are closely combined by presenting the case situations. By doing this, students can be guided to discover problems, analyze problems, and solve problems. Thus, students can master theoretical knowledge, develop their ability to analyze viewpoints and improve their operational capabilities.

Tunnel and Underground Engineering Theory is a course which needs very strong practicalness. The analysis of conditions for engineering geology and the selection, design, optimization and testing of underground structures are closely related to the practical engineering. The practical construction not only requires solid theoretical knowledge, but also rich engineering experience and strong engineering analysis ability. What's more, how to solve specific problems in the practical engineering is particularly valued. Therefore, it is necessary to analyze and explain many practical engineering cases in the teaching process so as to meet the teaching needs of cultivating high-level and high-quality professional degree graduate students.

3. Construction of Case Library and Teaching Plan

This paper, based on the theories in Tunnel and Underground Engineering Theory, has selected several typical engineering cases for case construction according to the authors' years of teaching. These cases contain typical engineering designs and construction practices. Coupled with relevant simulation engineering software, teaching cases with rich theoretical and practical knowledge and strong operability can be constructed.

3.1 The Construction Content and Process of Case Library

Taking the professional degree course of Tunnel and Underground Engineering Theory as an example, examples of typical tunnels and underground works are collected. The design, modeling, calculation and analysis process are included in the course case library by the calculation of large-scale commercial numerical analysis software. The case library for Tunnel and Underground Engineering Theory mainly includes ten case bases for the internal force simulation calculated by the "load-structure mode" and the design process of secondary lining of the tunnel, the simulation for the construction process of the double-track railway tunnel, and the simulation for the construction process of the subway shield tunnel. The main construction process is shown in Figure 1.

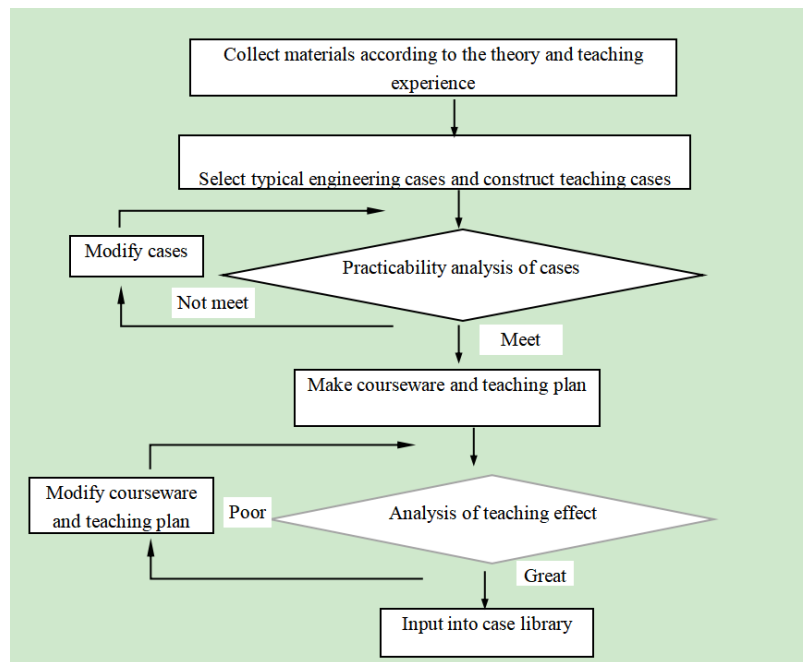


Figure 1 The Construction Process of Case Library

3.2 Teaching Plan for Case Library

In order to stimulate students' interest in learning and meet their learning needs, it is necessary to match the case base with the teaching plan. At the same time, the professional degree course of Tunnel and Underground Engineering Theory has the characteristics of comprehensiveness, wide span of knowledge, strong practicalness and typical cases. Therefore, combining with the characteristics of the course, the teaching plan of case library for this course is equipped with a variety of teaching measures to reach the teaching objectives, including the combination of theoretical teaching and practical operation, the combination of teaching cases and scientific research results, and the comprehensive application of multimedia information technology. [7] Thus, students can master the basic concepts, theories and design methods of tunnels and underground engineering, and can carry out corresponding practical operations independently. As a result, case teaching can guide students to think, stimulate students' interest so as to achieve the goal of professional degree graduate training.

(1) Combining the theoretical teaching and practical operation

The professional degree graduates are not only required to master theoretical knowledge, but also practical operation ability. In order to satisfy this requirement, basic knowledge learning, analysis process and technique application are included in the teaching process. In the teaching process, the teacher can guide the students to think and analyze, and do the preparation for the operation according to cases selected based on the basic knowledge. Then, students are directed to simulate and analyze these cases by the relevant simulation software. In such way, students' ability to solve problems and to operate can be exercised. Therefore, students can deepen their understanding and better mastery in the theoretical knowledge.

(2) Combining the teaching cases and scientific research results

The reform of the postgraduate teaching should combine the teaching and scientific research so as to integrate new scientific research results into practical teaching activities, such as the latest scientific research theories and scientific research techniques. Therefore, while acquiring the basic knowledge, students can have more understanding on the major and learn about research and development trends of the industry, thus enabling to inspire and guide students' cutting-edge thinking. This teaching form provides course knowledge for professional degree graduates studying in the relevant majors while contributing to cultivating professional and applied talents that meet the needs of contemporary development.

(3) Applying comprehensively the multimedia information technology

To improve teaching results, share teaching experience and build a wider platform for communication, multimedia technology can be used in case teaching with multimedia courseware and high-quality teaching plans so as to stimulate students' interest in learning. In addition, the related multimedia technology can be used by teachers and students who use this case library model for free. In this way, students can make a systematical learning in both class and after class, thus creating a better and more open teaching environment.

4. Features for the Construction of Case Library

4.1 Rich Teaching Content

Compared with traditional teaching, case teaching can provide rich cases and strong operational practices. According to years of teaching experience, the teacher has selected engineering cases that can better present the theoretical knowledge, and made them into teaching cases by computer technology. By doing these, teachers can provide rich practical knowledge for students in the class, and provides students with more practical methods. At the same time, the teacher's single teaching method has also been improved. Therefore, many typical cases were selected during the construction of case library for the Tunnel and Underground Engineering Theory. Meanwhile, by using computer technology, teaching cases are formed, thus enriching the teaching and providing various learning styles for students. Besides that, the teaching content is greatly enriched.

4.1 Strong Practicalness and Operability

Although the Tunnel and Underground Engineering Theory course values practicalness, the theoretical study and practical operation are not combined so closely in class. Therefore, after years of teaching practice, the case teaching mode, which focuses on increasing ability and basing on practices is gradually established. The selected cases should be "localized". Meanwhile, a situation, where students can be involved in, should be created. With these efforts, the graduate students can better participate in the case analysis under the guidance of the instructor and their ability to analyze and operate the real situations can be strengthened, thus stimulating students' interest in case learning and knowledge taught in class. As a result, the purpose to improve the effectiveness of teaching in class can be achieved.

4.2 Cutting Edge

As a high-level talent, graduate students are more sensitive to the direction of scientific research and easier to learn from scientific research. Therefore, the reform for postgraduate teaching should be combined with teaching and scientific research work so as to integrating new scientific research results into actual teaching activities. According to years' teaching practice, it has been found that simulation technology, as the cutting-edge technology of civil engineering development, has a significant promotion effect on enhancing students' interest in learning and improving teaching quality through practical application, which demonstrates its prospects for application.

5. Conclusion

The construction of the case library not only conforms to the development trend of contemporary education, but also meets the teaching needs of contemporary education, thus providing a great opportunity for cultivating professional and applied talents. For the construction of the case library, it does not merely mean to explain cases. It more than focuses on the selection of typical, excellent and cutting-edge cases according to the features of the course. By doing these, a high-quality course case library with rich teaching content, strong operation and cutting-edge can be built, and colorful teaching can be carried out by computer and multimedia technology.

The professional degree course of Tunnel and Underground Engineering Theory is mainly related to typical engineering design and construction practice. This feature lays the foundation of the knowledge system for the case teaching reform of civil engineering courses. Combining with relevant simulation software, students can carry out analytical simulations and practical operations while learning the wonderful cases, thus effectively improving their ability to operate and to solve

problem.

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