Study on the Course Teaching Method of Steel Structure Design Principles Based on the Engineering Case

Meizhen Fu Yuxiong Liang
East China Jiaotong University, Nanchang 330013, Jiangxi China

Abstract:

The Steel Structure Design Principles is a course with applicability and practicality. If the teaching method based on engineering cases was adopted,It would make the knowledge more intuitive and easier for students to understand, and cultivate students' ability to apply theoretical knowledge to analyse and solve the problems of practical engineering.The necessity of introducing engineering cases into the course teaching process of Steel Structure Design Principles was expounded in this paper , and the implementation plan and key point were also studied.

Keywords:

Steel Structure Design Principles; Engineering Case; Implementation plan

Introduction:

Steel structure design principle is a professional course for civil engineering students in engineering colleges and universitiesl. Its content covers the properties and selection of steel material, the performance of steel basic structure and the connection method of steel structure, etc.[1-2]. The course requires the students master the basic knowledge about the materials, components and connection of steel structure comprehensively, familiar with the relevant steel structure specification and structure, and can complete simple design and calculation[3-4]. The theoretical derivation and normative provisions occupy the dominant position[5].Most students cannot master the leading courses absolutely, lack of the learning effect and interest[6-8].. Therefore, it is imminent to reform the teaching method of the Steel structure design principle .

1 Necessity for teaching methods in engineering case courses

The course of Steel structure design principle is very applicable and practical. According to the latest engineering certification standards, after the study of this course the students should meet the following requirements: 1) identify the complex civil engineering problems using the basic principles of civil engineering knowledge; 2) can use the basic principles of structural design and design or development structural components; 3) can express the calculation process with professional terms and express the design results with drawings.Traditional teaching methods tend more to cramming teaching. Most students who had learned this course can only do the exercises, can not integrate the theoretical knowledge[6].Engineering case can connect theoretical knowledge with practical engineering cases,which is conducive to cultivate initiative and enhance students' confidence to solve difficulties

2 Implementation plan of course teaching with engineering case

Integrating engineering cases can improve students' learning interesting and knowledge mastery. Students can use engineering cases to improve the teaching effect.The implementation plan is as follows:

Firstly, choose the appropriate practical engineering case according to the teaching content, and attract the attention of the students by watching the photos or short videos of practical engineering case.The lecture content is combined with the cases to guide the students to think, analyze and discuss.

Secondly, reserve a certain thinking and discussion time, guide students to analyze cases independently, consolidate the knowledge points learned in the classroom, and try to expand as far as possible.

Finally, classroom summary, through the summary the students will firmly grasp the relevant knowledge, and know how to solve the practical engineering problems.

The engineering case course teaching method can draw near the teacher-student relationship. Teachers are no longer only lecturers, but also classroom leader.This interactive teaching mode can fully mobilize students' initiative in learning, and give

students full freedom.

3 Implementation key point of course teaching with engineering case

3.1 Reasonably select engineering cases according to the teaching content

First of all, we should make clear the relationship between the teaching content and the engineering case. Engineering cases should serve the teaching content, and the teaching content should correspond to the characteristics of the engineering case. Secondly, the selected engineering cases should be targeted and representative.

Example 1 , when I taught the content about steel structure characteristics, there was one characteristic of short steel structure construction cycle. Taking Huoshenshan and Leishenshan hospital as case in class. The hospitals using prefabricated steel structure system were constructed in about 10 days, whose construction area were about 33,900 square meters and 80000 square meters respectively.As witnesses to the battle against COVID-19, the students were impressed with this two hospitals, thus would deepen their memory and understanding of more knowledge points.

Example 2, the world-famous Quebec Bridge case, which undergo several collapse and reconstruction. On August 29,1907, a south string lever suddenly collapsed due to weak binding before the main span cantilever has been close to completion. The root cause was the unreasonable design making the lower chord unstable.The second collapse occurred in 1916, attributed to insufficient strength of connection details.The new bridge was finally completed in 1917, exceeding 2.5 times the dead weight of the old bridge.Through the cases, students have a deeper understanding of structural instability as well as the security and economy of structural design.

3.2 Reasonable course design

The teaching method based on engineering case is an open teaching mode. Students change from passive to active, and become the main teaching bodies, and then teachers are the guides.However, the course hours are limited in most school. So many contents should be taught, using the limited time to complete the course efficiently using teaching method based on engineering case depends on reasonable course design (take 2 class hours (90 minutes)as an example).

First ,According to the teaching content, the actual engineering cases (pictures or small videos) are introduced, which generally accounts for 5-10 minutes. It can achieve the purpose of attracting students' attention by raising questions and opinions about the engineering cases.

Second,the length of time should according to the teaching content but not less than 45 minutes. The teacher explains the relevant theoretical knowledge and formula derivation in detail, and sort out the context of knowledge.

Thirdly, students can think and discuss, which can account for 10-20 minutes. This link can be conducted in groups, or they can apply appropriate network to query relevant information. Actively guide the students to speak or discuss, and according to the students' performance or response, for the specific problems for appropriate guidance, effectively grasp the atmosphere of the classroom discussion, so as to achieve good results.

At last,According to the results of the students' discussion, the teacher summarize or the student (group) report to help students reflect on their performance in thinking, analysis and solving practical problems.The conclusions can also not be published leaving students to do further thinking.

Teaching method based on engineering case puts forward higher requirements for teachers, but also requires students to take greater initiative in learning.It can encourage teachers to find engineering cases that are consistent with the classroom content and enrich their theoretical knowledge and practical engineering experience, and then feedback to the classroom.

4 Conclusion

Teaching method based on engineering case can strengthen the connection between theory teaching and practical engineering. It will make abstract knowledge visualization, and can conducive to the expansion of students' thinking,also promote students master the professional knowledge more quickly and connect the theory with the practical engineering,as well as warn themselves by fail engineering cases to avoid similar accidents in their future work.Therefore, application of practical engineering cases into the teaching can promote the improvement of teaching quality.

References:

[1] Chen Shaofang, Gu Qiang. Steel structure-Steel structure foundation [M]. Beijing: China Construction Industry Press, 2017.

[2] GB 50017-2017, Design Standard for Steel Structure [S].

[3] Sun Yuanxi, Yan Li'e. Teaching Reform Analysis of Steel Structure Curriculum in Civil Engineering [J]. Comparative Research on Cultural Innovation, 2019,3 (34): 78-79.

[4] Song Gaoli. Teaching Reform explore of Steel Structure Design Principles Curriculum in Civil Engineering [J]. Higher Construction

Education, 2016,25 (4): 62-64.

[5] Tian Qin, Liu Xinqi. Teaching Reform Research of Steel Structure Design Principles Curriculum [J]. Higher Education 2020,10(4):3-4.

[6] Ming Xin, Yang Nan, Tong Zhou. Research on Teaching Reform of "Steel Structure Design" Based on Practical Ability Training [J]. Technology Views, 2021 (28): 26-27.

[7] Wu Shifeng. Application and Optimization of Case Teaching Method in Heat Transfer Course [J]. Education and Teaching Forum, 2021 (6): 149-152.

[8] Shen Zongyang, Li Kai, Li Runrun,et al. The Application of Case Teaching Method in Professional course —takes the "inorganic material physical performance" course as an example [J]. Journal of Anhui Electronic Information Vocational and Technical College, 2021,20 (4): 30-33.

About the author:

Meizhen Fu (1987.03-), female, Han, Ji'an City, Jiangxi Province, School of Civil Engineering and Architecture, East China Jiaotong University, PhD, lecturer, research direction: steel structure, wood structure and composite structure.

Yuxiong Liang (1985.06-), male, Han, Pingliang City, Gansu Province, School of Civil Engineering and Architecture, East China Jiaotong University, PhD student, engineer, research direction: steel structure bridge construction control, railway bridge vibration theory.