

Teaching Reform and Practice of Civil Engineering Construction Technology Course in Private Universities Based on "Competition of Construction Technology Application Skills"*

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Abstract—This paper analyzes the problems existing in the civil engineering construction technology course. Based on the "Competition of Construction Technology Application Skills", the teaching reform is carried out from the aspects of the division of the curriculum modules, the teaching methods, the practical teaching and the assessment methods. The effects of the curriculum reform and existing problems are summarized.

Keyword—*construction technology; teaching reform; professional needs*

I. INTRODUCTION

The Civil Engineering Construction Technology Course is a very important professional core course for majors related to civil engineering, engineering management and engineering cost. It aims to train students' ability to guide construction at the construction site in the future. As a theoretical, practical and comprehensive curriculum, it is also the foundation for students' reasonable construction organization; students must be able to guide on-site construction based on theoretical knowledge. Xi'an FanYi University is a private university, and the majority of students will be engaged in construction management, etc. in the future. From the perspective of application and students' employment, the study of construction technology course is very important.

II. ANALYSIS OF EXISTING TEACHING PROBLEMS IN THE COURSE OF XI'AN FANYI UNIVERSITY

A. *The Theoretical Foundation of the Students Is Poor, and the Grasp of the Pre-requisite Courses Is Not Ideal*

Civil engineering construction technology involves more knowledge points, and there are more pre-requisite courses, mainly including Civil Engineering

Materials, Soil Mechanics and Foundation, Housing Architecture and many other professional foundation courses; because the students' basic level is not high, the learning of

the pre-requisite courses is not perfect, and they can't comprehensively analyze and apply knowledge points, which directly led to the unsatisfactory learning effect of this course.

B. *Teaching Methods Are Single, and the Classroom Atmosphere Is Not Active*

The traditional teaching is mainly taught by the instructor in the form of "cramming", with curriculum design and off-campus

training as supplement; because the content of this course is more, the knowledge points are scattered and the content is relatively boring, although the teachers mainly use multimedia teaching, and play pictures, animations and videos to assist the teaching [1], there will still be quite a few students not interested the course. The teacher can't fully mobilize the enthusiasm of students to learn, so that the study of theoretical knowledge is not ideal.

C. *Off-campus Training Is Too Random with Less Training Hours*

The course training mainly focuses on off-campus visits after the end of the course. However, due to the characteristics of the project, the time, place and training content of the practice are random, which brings great disadvantage to practice. At the same time, due to the short training time, most of the training is in the form of skimming the surface. They cannot participate in the whole process of the whole project construction, and cannot achieve the purpose and requirements of the training; the students' ability to guide the actual construction is poor. It is far from the future professional needs of students.

D. *Teachers Lack Practical Engineering Experience*

The teachers of this course in this school are mainly young and middle-aged teachers. Most of the teachers directly engage in teaching work after graduation. They have no practical experience. Although their theoretical knowledge of teachers is relatively solid, they lack practical experience [1], so they cannot explain combining with

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engineering practice. This is one of the reasons why the classroom is dull and the teaching effect is not good.

III. THE REFORM OF THE COURSE

In response to a series of questions in the course of the lectures and feedback from students and employers, the course has been comprehensively reformed. It is hoped that students will master the basic construction methods of the project while fully grasping the theoretical knowledge to achieve the purpose and requirements of the application of talent training. The reform of the curriculum is mainly carried out in the following aspects.

A. Revising the Course Syllabus

The update speed of construction technology is often faster than the update speed of books. It is necessary to further strengthen the cooperation between schools and enterprises, organize teachers to conduct research on different enterprises, similar institutions and schools with strong civil engineering major, and accept feedback from employers mainly including construction enterprises. According to the specific situation of our students, the curriculum leaders of the enterprises and related institutions and the dual-teachers of our department jointly plan the content of the course, and revise the course syllabus. The lesson plan for the course is jointly written by the teachers of the course group after collective discussion.

B. Module Division of Knowledge Structure

In the theoretical content of the lecture, combined with the theoretical knowledge of the construction skill contest and the virtual simulation training platform used in the simulation practice section, the course is divided into modules, including the following modules: foundation and foundation engineering (including earthwork and deep basic engineering), main work (including masonry structure, reinforced concrete structure and pre-stressed concrete structure), roofing engineering, decoration and fitting-out works and assembly structure.

The teacher of the class will classify and summarize the topics related to the construction technology in the construction contest theory question bank according to the content of the divided modules. The instructor will explain the contents of the theoretical question bank in the theoretical lecture, which can test the students' mastery of theoretical knowledge. In addition, the theoretical part of the construction competition combines the current construction-related specifications, such as the "Construction Code for Concrete Structure Engineering" and "Construction Quality Acceptance Specification for Concrete Structure Engineering" and many other specifications for construction and acceptance. These specifications are not covered in the book. Allowing students to contact the relevant content of the specification in advance can enable students to expand their knowledge and lay a good theoretical foundation for future construction work.

C. Reform of Teaching Methods

On the basis of the original teaching method, the explanation of knowledge points should be combined with small video of the construction site. The video is not limited by various factors such as time and place like outside-school training, so the students can actually experience the construction method of division component project of different projects; in addition, the original teaching method is mainly based on the teacher's lecture and the students rarely participate in the classroom. The teacher can combine the form of flipped classroom in the lecture, which enables the students to participate in the classroom extensively. For example, in the concrete structure, for the calculation of the mix ratio of concrete construction, teachers can organize students to make after-school preparations, explain the derivation of formula and explain the examples. In this way, students' participation can be greatly improved, and students' enthusiasm and interest in learning can be greatly enhanced.

D. Reform of Practice Teaching

1) *Deleting course design training:* It is suggested to re-plan and integrate the original off-campus training and curriculum design training. Considering the future professional needs of students, we can delete the original curriculum design part training. [3] From the previous curriculum design, it can be seen that most students only copy the design of other students, and only a small number of students understand the basic methods and contents of the curriculum design. They do not really achieve the purpose of making students think independently and exercise their brain skills, which wastes the time of course training.

2) *Reform of off-campus and on-campus training:* The integrated training is divided into two parts: off-campus training and on-campus training. Off-campus training is mainly based on off-campus visits. Students are led by teachers responsible for internship team. Because these teachers are experienced in off-campus training, they will avoid the problems in off-campus internships. The in-campus training is mainly charged by the course teacher. Combining with the virtual simulation training platform adopted by "Construction Skills Competition", it is interspersed in the theoretical course teaching process. Because the theoretical part of the construction is relatively scattered knowledge points, students neglect that the construction method is coherent in the construction process, and the construction simulation in the virtual simulation platform is carried out continuously according to the construction sequence. The teacher's operation demonstration and the students' simulation of the construction and management of the construction site help achieve the purpose of better grasping the logical relationship in the construction of the project and construction methods of different division component projects.

3) *Establishing an open virtual simulation training room:* Due to the limited time available in the classroom

and the limited time for students to practice in the school, the special training room for our engineering application software is set as an open training room. Students with interests can do virtual simulation training in their spare time after a simple registration, so that they can not only make full use of the school's effective resources, but also make some students no longer in the state of "doing nothing" in their spare time and students with interests can use their spare time to study.

E. Examination Reform

The traditional final exam scores are usually composed of the final exam paper and a certain percentage of the usual grades. This assessment method ignores the performance of the students in the usual classroom, so that the students can pass the exam through general review of the book before the final exam. The assessment method has not been able to stimulate students' interest in ordinary learning, which is not conducive to students' learning and teachers' classroom teaching. The test scores is divided according to the specific conditions of this course, mainly including the following aspects:

- Ordinary results mainly examine students' usual attendance, class attendance, and handing in paperwork, etc., accounting for 10% of the total score;
- Theoretical simulation test: based on the theoretical knowledge taught by the teachers in class, combined with the theoretical knowledge of the construction competition, the usual test is carried out mainly to examine the students' understanding and digestion of the classroom content and related norms, accounting for 10% of the total score;
- Training results: including off-campus training and on-campus training. The results of off-campus training are given by the team teacher, examining the performance of the students' off-campus training and the writing of the training report. The training in the school mainly examines the students' performance in the classroom training and the submission of the training assignments. The off-campus and on-campus training in the school accounted for 15% of the total score respectively;
- Final exam: The final exam mainly combines the theoretical content and the training part. In the form of a paper test paper, the students' overall knowledge of the theoretical content and training content is examined, accounting for 50% of the total score.

F. Organizing the School Construction Skills Competition

It is necessary to organize all students in the Department of Civil Engineering of the school (including higher vocational and undergraduate, mainly junior undergraduate and sophomores students of higher vocational education) to participate in the construction skills competition in the school. The school competition is completely in accordance with the national competition system, composing of theory and actual simulation. Through the participation in the

school competition, the students get better exercise, which can also examine the effects of the curriculum reform. The school competition can also select excellent competitors for the national and provincial competitions, to improve the visibility of this college. The school competition can be used as a regular competition in the second classroom of the school. It is held once a year to allow more students to get an exercising chance, cultivate students' competitive awareness in the competition, and achieve the goal of promoting teaching, learning and practicing by competition.

G. Construction of the Teaching Staff

The faculty of the course is relatively young, and most of them have no engineering practice experience. It is necessary to organize the course group teachers to go to the relevant enterprises for on-the-job training and outing training or participate in the construction technology academic conference [5], so that the teachers can carry out the learning of theoretical knowledge and practice experience to improve their professional knowledge, update new construction techniques and construction technology in the course of teaching, and provide necessary conditions for better teaching of the course in the future; teachers are encouraged to obtain relevant qualification certificates for the civil engineering industry.

IV. THE EFFECT RECEIVED

A. Improvement of Theoretical Knowledge

Through the combination of the theoretical content of the course and the relevant theories of the competition and the reform of the assessment method, students can better grasp the theoretical knowledge acquired from the book and give students the opportunity to learn the relevant specifications such as construction and construction acceptance, which has broadened the horizons of the students and laid a good theoretical foundation for the future work of the students.

B. Improvement of Practical Ability

Through the combination of off-site construction site training and on-campus virtual simulation platform training, students have a deeper understanding and mastery of the construction of specific projects, and better grasp the logical relationship between the engineering construction processes. They can specifically understand and master the construction process of various engineering structures including masonry structure, frame structure and other structures, which are not available in books and can increase the ability of students to operate and think. It also makes students master the relevant specifications in the field of construction technology. These are indispensable for students to engage in construction and management work in the future, and also laid a solid foundation for students to continue to study civil engineering construction organizations in the future.

C. Improvement of Learning Interest and Learning Effect

Through the comprehensive reform of the civil engineering construction technology course, the problem that students are not interested in class and the unsatisfactory

effect of the teacher's teaching is fundamentally solved. The students have changed passive learning to active learning, which has improved the effect of classroom teaching and achieve the win-win situation for teachers and students. Through the organization of the school construction skills competition, students have the opportunity to participate in the competition and practice, so their competition awareness has been greatly improved, so that they have sufficient motivation and pressure for the study of professional courses in future. This improves students' interest in learning and their learning enthusiasm and initiative.

V. EXISTING PROBLEMS AND REFLECTIONS

A. *The Course Time Is Relatively Short*

The class time is generally 48 hours, and the overall class hours are less. It is not enough to fully teach the lectures on the theoretical and practical content of the course. In the future, it can be considered to increase the class hours by about 10 hours when making the talent training program.

B. *Conducting the SPOC Hybrid Teaching*

It is necessary to organize the research team members to declare the online open course, record the lecture video of the course, organize the students to conduct unit test and answer the questions, and use the network resources to learn; this can organize students to study on their own after school hours and make full use of the spare time.

C. *Construction of School-based Textbooks*

Most of the textbooks for construction technology courses are similar. The update speed of textbooks is much slower than the speed of knowledge update. In order to better adapt to the training of applied talents and adapt to the reformed content and practice teaching, the school will organize teachers of this course group to combine the theory and practical content of the construction competition to prepare the school-based textbooks.

VI. CONCLUSION

In summary, through the comprehensive curriculum reform of the civil engineering construction technology course, the students' construction technology professional knowledge level, hands-on operation and thinking ability have been improved, which laid a good foundation for future on-site construction work and provide the necessary guarantees for the follow-up related courses; the teaching reform of the course provides some reference for the teaching reform and practice of other professional courses.

REFERENCES

- [1] Guo Shihui. Study on the Teaching of Civil Engineering Construction Course under the Background of Local University Transformation — Taking Nanyang Institute of Technology as an Example[J]. Journal of Nanyang Normal University, 2018,17(6):76-78. (in Chinese)
- [2] Li Yangyang, Feng Songbao. Teaching Reform of Construction of Civil Engineering Company Based on Practical and Applied Types[J]. Yinshan Academic Journal, 2017,31(4):139-141. (in Chinese)

- [3] Hua Jianbing, Sun Aiqin. Discussion and Practice of Optimizing the Teaching Method of "Civil Engineering Construction" Course[J]. Application-Oriented Higher Education Research 2017, 2(2): 45-47. (in Chinese)
- [4] Zhou Guo'en, Liang Xin, Zhou Yu. Exploration and Practice of Simulation Technology in Civil Engineering Construction Practice Training[J]. Education Teaching Forum, 2017, (28): 197-198. (in Chinese)
- [5] Tu Jinsong, Ge Haiyu. Teaching reform of civil engineering construction course in application-oriented colleges and universities[J]. Journal of Architectural Education in Institutions of Higher Learning, 2012, 21(3): 94-97. (in Chinese)
- [6] Yang Huijun. Research on Teaching Model Reform of Civil Engineering Construction Course[J]. Education Modernization, 2017, 13(023): 58-59. (in Chinese)