

Exploration and Practice of Teaching Reform of Construction Equipment Engineering Course under Mixed Teaching Mode

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Abstract

The construction equipment engineering course is a professional basic course for the installation direction of the engineering cost major of Southwest Petroleum University. With the development of the times and technology, the traditional teaching mode can no longer meet the current education needs. This paper analyzes the existing problems in the teaching of construction equipment engineering courses, combined with previous teaching experience, and proposes a mixed teaching model, in order to provide new ideas for classroom teaching, enhance students' interest in learning, strengthen theoretical learning, and help the direction of engineering cost and installation Learning Content.

Keywords

Construction equipment engineering; Teaching reform; Blended teaching.

1. Introduction

Construction Equipment Engineering is a professional basic course for the installation direction of the engineering cost major of Southwest Petroleum University, and its course content is an essential part of modern architecture. Its content includes building water supply, drainage, gas, ventilation and air conditioning systems, building fire protection systems, building electrical and building lighting, etc.[1]. Taking our school as an example, the corresponding content and hours of the course are shown in Fig. 1. Looking at the colleges and universities that have engineering cost majors in our country, "Construction Equipment Engineering" plays an important and indispensable position in terms of professional training goals and students' employment needs [2].

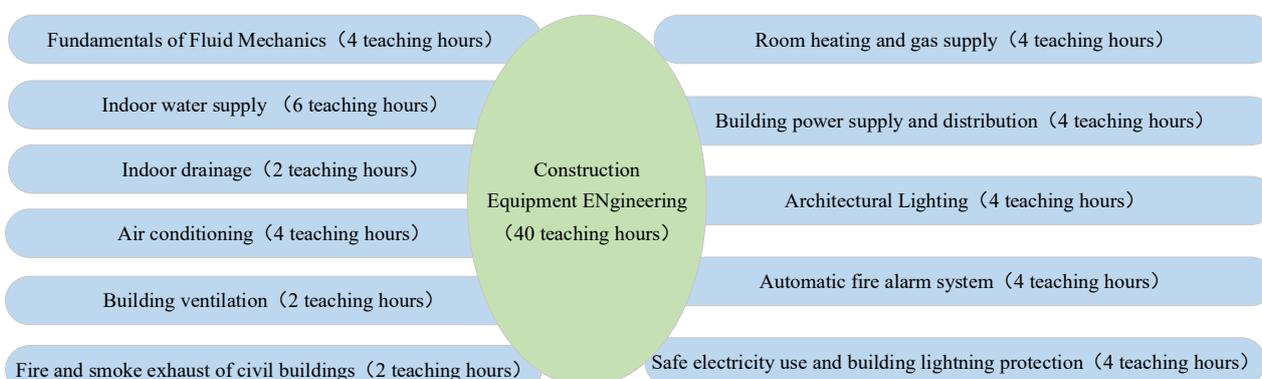


Figure 1. Course composition of construction equipment engineering

With the continuous development of science and technology, the update of construction equipment technology is also changing with each passing day, and it is relatively difficult for

students to learn. Blended teaching is a teaching that integrates advanced teaching technology and teaching methods according to the teaching content[3,4]. Compared with traditional teaching, blended teaching integrates a variety of teaching methods, and its characteristics of openness, innovation and inclusiveness make teaching methods more diversified, such as project teaching method, problem teaching method, case teaching method, etc.[1,5,6]. At the same time, blended teaching is also combined with information technology to fully explore the advantages of network resources. Because of this, the blended teaching method is gradually becoming the mainstream direction of teaching reform and exploration in colleges and universities. In addition, the blended teaching method can also provide students with a relatively individualized learning process, respecting individual differences of students. The interaction between teachers and students in the classroom helps teachers to teach students in accordance with their aptitude, integrate "teaching" and "learning" organically, and promote the reform and innovation of classroom teaching[7].

Based on the current teaching situation, the author switches different teaching scenarios flexibly according to the teaching objects, starting from the teaching content, teaching ideas, teaching methods, and teaching assessment, and truly realizes the seamless integration of various teaching methods, so that teaching activities can be better serve the teaching goals.

2. Current Problems

Construction equipment engineering is a professional basic course offered in the fifth semester of the engineering cost major of our school. Prior to this, students have studied some pre-professional courses. According to the talent training plan for engineering cost professionals, the course syllabus, the relationship between old and new knowledge, and the learning characteristics of students, combined with industry characteristics and professional orientation, the status and goals of the course are shown in Figure 2.

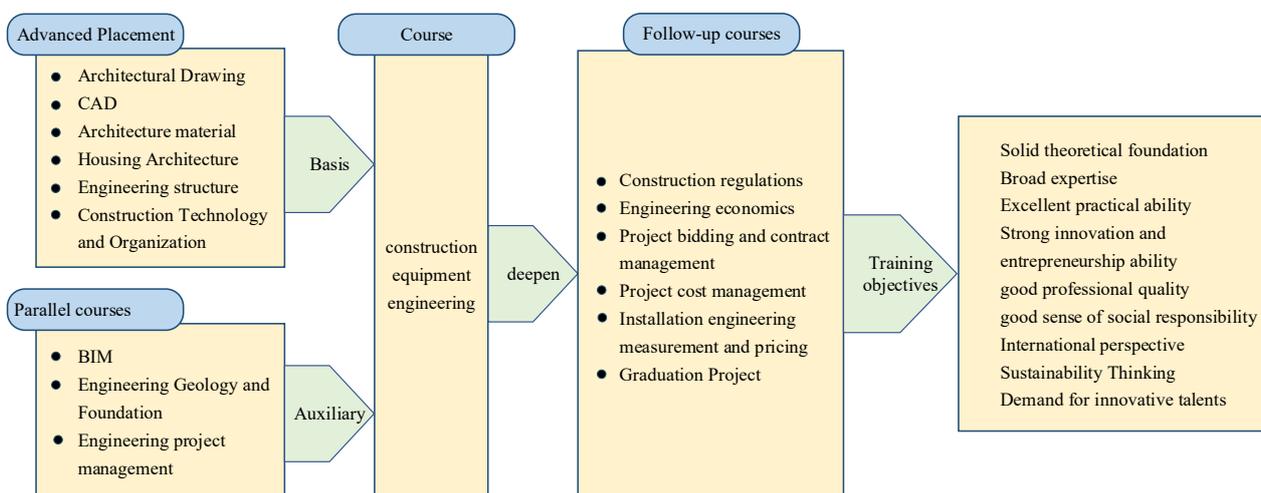


Figure 2. Schematic diagram of course status and goals

Since construction equipment engineering is a basic course for the installation direction of engineering cost majors, if students fail to learn theoretical knowledge well, it will be difficult for students to learn both installation measurement and pricing or installation software. In this context, how to cultivate a group of high-level construction equipment professionals has become the primary problem to be solved at present. Based on the actual teaching process, the author summarizes the main problems existing in the current teaching process of construction equipment engineering courses, as follows:

(1) The course content is large, and the curriculum teaching period is small, and the content cannot reflect the professional characteristics. Due to the small correlation between the contents of each chapter of the whole course and the small amount of curriculum teaching period, the content of the students' learning is not deep enough and superficial, only the mastery of basic concepts, such as air conditioning principles, building ventilation calculation, smoke exhaust law of civil buildings, etc., which are restricted by curriculum teaching period, and cannot be taught.

(2) The teaching objectives are vague, and the content is out of touch with the advanced technology in practice. The teaching content in the textbook is relatively outdated and has not been updated in time. With the rapid development of intelligent construction, students know very little about the current construction equipment technology in the learning process. In the classroom, teachers can only use multimedia to play pictures or use videos to cooperate with the explanation, and the teaching method is single, which discourages students' enthusiasm for learning.

(3) Teaching is mainly in a cramming-style teaching-based approach. In the course of course teaching, teachers mainly rely on multimedia-assisted explanations, including the explanation of concepts, principles, and relevant standards. Students are very passive in the learning process, resulting in low learning efficiency.

3. Teaching Reform Exploration and Practice

Through the implementation of the teaching mode of task-driven, interest-guided, and the combination of production, education and research, and the rational and appropriate use of information-based teaching methods, the teaching activities of "pre-class preview, in-class discussion, and after-class extension" are comprehensively carried out. In the course of teaching, abstract problems are visualized in animations, videos, etc., and BIM modeling technology is used to present new techniques and technologies in the construction industry, so as to expand students' cognition of the industry and broaden their horizons. The specific teaching reform exploration includes four parts: teaching content, teaching ideas, teaching methods, and teaching assessment, as shown in Figure 3.

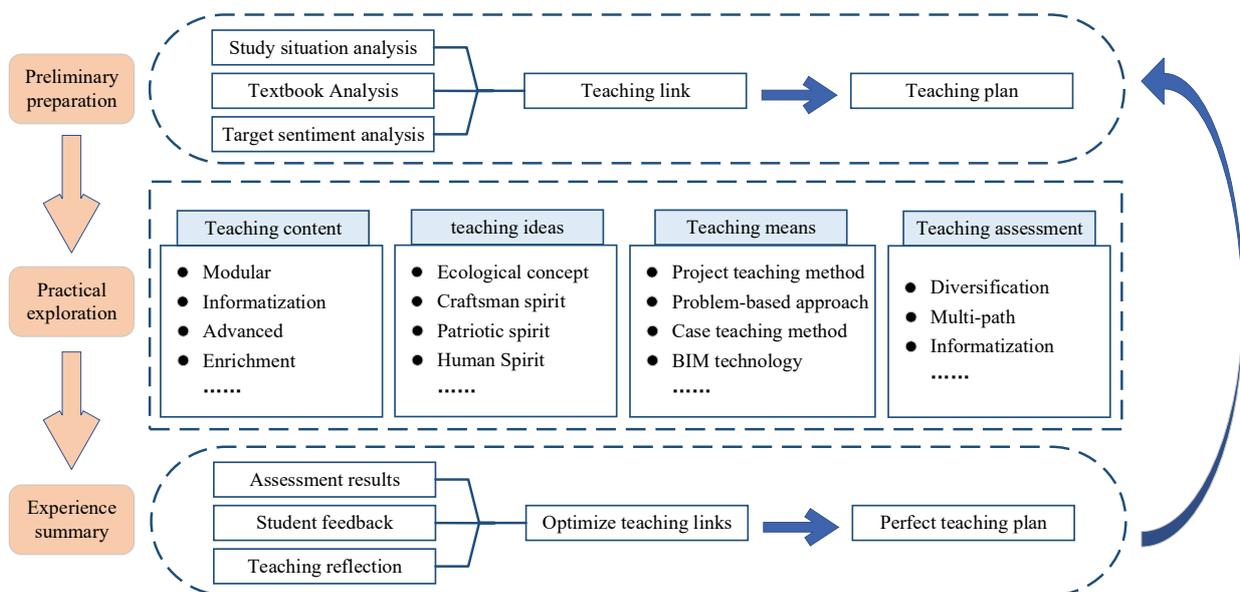


Figure 3. Exploration of Teaching Reform

(1) Teaching content. The courses are divided into modules according to the teaching content, so as to increase the research and practicality of the taught content. For example, computational fluid dynamics (Computational Fluid Dynamics, CFD) numerical simulation software and related scientific research are introduced in the extracurricular extension of indoor water supply and drainage based on fluid mechanics. At the same time, it can be combined with the oil and gas storage and transportation major of the school to popularize the examples of pipeline transportation projects to students and broaden their knowledge. In the course content of civil building fire and smoke exhaust and automatic fire alarm system, the introduction of Fire Dynamics Simulator (FDS) numerical simulation software and related scientific research is extended. At the same time, based on actual large-scale fire cases, combined with numerical simulation and experimental results, the law of fire evolution and the characteristics of personnel evacuation are taught to strengthen students' awareness of fire safety.

(2) Teaching ideas. Based on the existing teaching content, based on the ecological concept, craftsman spirit, love spirit, humanistic spirit, etc., to identify the ideological and political connotation of construction equipment engineering courses, and give full play to the moral education function of professional courses. For example, when explaining the materials of building drainage pipes, by combining different engineering examples, let the students discuss the advantages and disadvantages of the plastic pipe drainage system and the cast iron pipe drainage system as well as the applicable places, so as to guide the students to have a high sense of responsibility, professional spirit, guarantee the high quality of the construction and installation industry development. For another example, in teaching the quality inspection and acceptance of drainage pipes, we can cultivate students' sense of responsibility, overall concept and rigorous and realistic spirit by incorporating strict technology and craftsmanship.

(3) Teaching methods. Abandoning a single teaching method and adopting a blended teaching method allows students to participate in the course and actively learn the course content. Before the class, upload the extended content of the course in the form of video, picture or short text introduction on the "Learning Pass" or "Rain Class" software. In the class, through the project teaching method, problem teaching method, case teaching method, etc., and combined with the characteristics of the course, Building Information Modeling (BIM) is introduced, so that students can more intuitively understand the layout and function of building equipment. After class, open assignments are arranged according to the content taught and combined with the current construction equipment technology, and students are required to complete them in the form of design, report and report.

(4) Teaching assessment. The total grade of the course (100%) = normal grade (30%) + final grade (70%). Among them, the final grades are mainly through closed-book examinations, and the usual grades mainly rely on attendance and homework, and the assessment method is single. In order to make the grades more abundant and comprehensive, in the course of teaching, the group is required to work together to complete the after-school tasks. For example, reporting assignments requires team members to collect data, make PPT, and demonstrate and explain. Each link requires the cooperation of team members, so that students can master the knowledge while also cultivate teamwork spirit, improve students' comprehensive quality, and achieve teaching goals.

4. Effect Analysis

Taking 165 students of the 2019 grade of engineering cost of Southwest Petroleum University as the teaching reform practice object of the construction equipment engineering course, the graduation results of the course are shown in Figure 4. Among them, 83 people in the experimental group are teaching class one, and 82 people in the traditional teaching group are

teaching class two. According to the test results, after adopting the blended teaching mode, the proportion of students in the 70-79, 80-89 and 90-100 fractions in the experimental group is slightly higher than that in the traditional teaching group. At the same time, the proportion of people in the 0-59 and 60-69 fractions in the experiment was significantly lower than that in the traditional teaching group. It shows that after adopting the teaching reform measures described in the paper, the practical effect is more obvious.

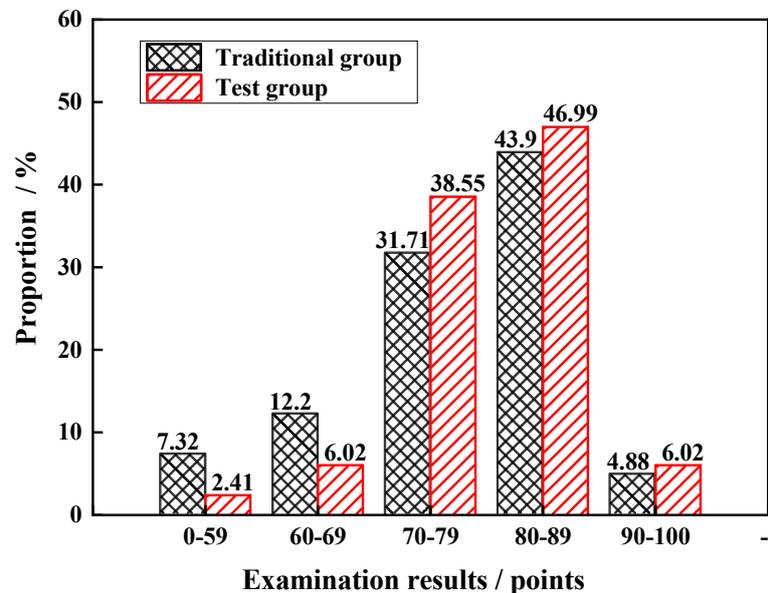


Figure 4. Examination results of the experimental group and the traditional group

Although the blended teaching mode has achieved good practical results, the effect is not significant due to the short development time. In the course of teaching, due to the reform model adopted for the first time, the teaching effect is far below the design goal. Through a questionnaire survey on the learning effects of 165 students in the 2019 engineering cost major of our school, it was found that 82.6% of the students agreed with the reformed teaching methods; 92.4% of the students believed that there were some Great gains, and a more comprehensive understanding of construction and installation in my country; 94.8% of the students expressed that they have increased their interest in learning through the teaching reform described in the text, and are satisfied with the entire course arrangement of Construction Equipment Engineering.

5. Conclusion

With the vigorous rise of the construction industry, China requirements for talents in the construction industry are getting higher and higher. In order to avoid "heavy civil construction and light installation" and further promote the teaching effect of construction equipment engineering, through the reform of the mixed teaching mode, the teaching content, Teaching ideas, teaching methods, teaching assessment and other aspects have been explored, in order to enhance students' interest in learning, strengthen the theoretical study of construction equipment, and help install the content of cost courses. In the process of teaching reform and practice, by cultivating students with solid basic theory, broad professional knowledge, excellent practical ability, strong innovation and entrepreneurship ability, good professional quality, and a certain international vision and sustainable development thinking, to meet the new era of project cost complex type and innovative talents.

Although the teaching reform practice has made progress, there are still some problems in the teaching process. The teaching process is mainly based on theory, and engineering examples can only be explained through video, pictures or text. However, in practical engineering, construction problems are often varied. Due to the limitation of practical conditions, students cannot visit the existing construction equipment, resulting in a weak connection between theory and practice. These will be problems to be solved urgently in the teaching process of construction equipment engineering in the future.

Acknowledgments

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References

- [1] J.E. Jia: Research on the Application of Hybrid Teaching Mode in the Course Teaching of Building Equipment, *Sci-tech Innovation and Productivity*, Vol. 318 (2020), p. 91-93. (In Chinese)
- [2] J. Liu, K. Li, X. Hu, et al: Exploration and Practice of Teaching Innovation Reform of "Construction Equipment" Course in Engineering Management Major, *Educational Watch*, Vol. 9 (2020) No. 37. (In Chinese)
- [3] J.J. He: Exploration and Research on the Blended Teaching Mode of "Construction Equipment Engineering", *Modern Business Trade Industry*, Vol. 41 (2020) No.18, p.177. (In Chinese)
- [4] Y. Zhou, C. Meng: An Preliminary Exploration of Blended Teaching Model on Building Equipment Course, *Journal of Ningbo Polytechnic*, Vol. 22 (2020) No. 3, p.27-30. (In Chinese)
- [5] K. Li, J. Liu, X. Hu: Talking about the innovative teaching reform and practice of the course "Introduction to Construction Equipment" for undergraduate engineering management majors, *China Plant Engineering*, (2021), No. 16, p.2. (In Chinese)
- [6] X.B. Cao: Practice and exploration of construction equipment course based on online teaching mode, *China Plant Engineering*, (2020), No. 16. (In Chinese)
- [7] C.H. Guo: Research on the application of fractional classroom teaching mode in architectural Decoration design course, *Art Education Research*, (2019), No. 3. p.122-123. (In Chinese)