Innovative Reform of Engineering Drawing Course Based on Design Project Drive

Zhao Mingxia
State Grid Jibei Electric Power Company Limited Skills Training Center
Baoding Electric Power VOC.& TECH. College
Baoding, China

Abstract: Under the background of deepening the reform of vocational education, vocational schools and professional teachers are trying more teaching methods and using more advanced teaching methods. Based on the existing research theories and achievements, this paper takes the engineering project professional skills training as an example, explores how to combine the work content with the project teaching content, optimizes the project teaching, improve the teaching quality of the engineering project related courses, improves the teaching effectiveness and enriches the teaching theory, so as to improve the theoretical research of relevant courses for reference and find out the way and general law of project teaching implementation, and construct the project teaching mode with secondary vocational characteristics, and update the education and teaching concept, and help the project teaching reform, and promote the comprehensive, coordinated and sustainable development of secondary vocational schools.

1. Introduction
Project teaching method, a kind of teaching method, refers to the teaching design of teachers around an independent and complete project, which is designed into several tasks. Each task has a corresponding assignment book. Under the guidance of teachers, students can independently or cooperatively explore and complete the task. By collecting relevant data, making plans, implementing tasks, displaying results and summarizing and evaluating, students can complete knowledge learning and skill improvement [1]. Project teaching method has the following characteristics: first, it changes the status of teachers and students in traditional teaching, and teaching activities fully embody the student-centered and strengthen the principal position of students, and teachers are the guiders, question-solvers and evaluators [2]. Secondly, the project teaching takes the post demand as the guidance, takes the typical work task as the carrier, realizes the integration of theory and practice, and cultivates the real skilled talents. Moreover, the implementation of the project depends on a certain situation, which is all transferred from specific jobs in the enterprise, which can arouse the interest or resonance of students and improve their professional identity and spirit. Finally, it can be presented with certain results, either students' works or students' services, so as to increase students' motivation and sense of achievement in learning and improve their skill level [3].

2. Teaching basis of project team teaching
Project teaching method is to introduce the scene of actual work into the teaching. Classroom learning revolves around a practical work project, takes the work task as the main line, and under the guidance of teachers and students as the center, students complete work tasks independently and cooperatively,
so as to acquire new knowledge and master work skills [4]. Based on the actual work tasks of enterprises, project teaching can fully mobilize students' interest in learning, meet the needs of students' vocational ability and enterprise work, and realize the cultivation of skilled talents, which has been recognized by more and more vocational school teachers [5]. At the same time, vocational schools and professional teachers have carried out active exploration on project-based teaching, and have made some achievements. However, due to the lack of systematic theoretical guidance, many problems have been encountered in the practice of project teaching, such as the selection of projects, the practice of project teaching and the formulation of teaching evaluation and assessment system [6]. Engineering project is a new discipline developed from the major of construction engineering management, which is based on economics, management and civil engineering [7]. Project management is needed in the whole process from commencement to completion. The working units mainly include construction units, construction units and project consulting agencies. The demand for talents is very large and the development opportunities are broad. The theoretical knowledge of engineering project specialty is boring, and students are not interested in theoretical teaching [8]. In traditional teaching, theory and practice are separated. Usually, each course is taught theory first, and then a week or two of practice is left at the end of the semester for practical training. Students need to speak the theory again during the training, which is a waste of time and is not conducive to the formation of students' skills. Project teaching reform is carried out. When explaining and analyzing the principles and methods of the project, specific projects are introduced in time according to the sequence from simple projects to complex projects [9].

3. Construction of project team teaching system

The whole course takes the project of the national engineering training comprehensive ability competition as the main line and penetrates every knowledge point of the whole course. From part design, part engineering drawing, 3D assembly to the final assembly engineering drawing, the 3D design and engineering drawing of the whole project [10] are completed, as shown in Figure 1.

![Figure 1 Relationship between 3D design project and teaching curriculum](image)

At the end of the whole course, students can finish the three-dimensional modeling of watch parts, the assembly of watches, the parts engineering drawings and assembly engineering drawings of various parts and assembled watches, and complete the whole CAD design process of a complete product. In this way, the engineering graphics, three-dimensional modeling and assembly, as well as the drawing of two-dimensional engineering drawings are organically linked, and the three-dimensional modeling is really implemented throughout the whole process of engineering drawing, and a complete teaching content system of three-dimensional design and engineering drawing is constructed, which is conducive to students' independent learning and cultivating their practical ability [11]. The curriculum system is shown in Fig. 2.
Teaching method of teachers' team

The teaching method of a teacher team is to form a teaching team composed of several teachers. According to the professional background and characteristics of each teacher, the chapter or topic that the teacher is good at is selected, and the teaching task of a certain course, a certain class or several classes is shared by several teachers, as shown in Table 1. The teaching system of 3D design and engineering drawing teachers' team is shown in Figure 3.

Table 1 3D design and engineering drawing project-based team teaching system

| Teaching content arrangement | Item | Teacher team arrangement |
|------------------------------|------|--------------------------|
| Basic theoretical knowledge of engineering drawing | Part engineering drawing national standard frame drawing | Teacher 1 |
| Basic knowledge of CATIA engineering drawing | Read part engineering drawing | Teacher 2 |
| Part drawing theory knowledge | 3D modeling of parts | Teacher 1 |
| CATIA part 3D modeling practice operation | 3D model call of standard parts, gear generation, spring modeling | Teacher 2 |
| Theoretical knowledge of standard parts and common parts | Part drawing generation | Teacher 3 |
| CATIA part drawing practice operation | 3D assembly | Teacher 2 |
| CATIA 3D assembly practice | Read assembly drawing | Teacher 1 |
| Assembly drawing theory knowledge | Assembly drawing, exploded drawing generation | Teacher 3 |
| CATIA assembly drawing practice operation | | |

4. Teaching method of teachers' team

The teaching method of a teacher team is to form a teaching team composed of several teachers. According to the professional background and characteristics of each teacher, the chapter or topic that the teacher is good at is selected, and the teaching task of a certain course, a certain class or several classes is shared by several teachers, as shown in Table 1. The teaching system of 3D design and engineering drawing teachers' team is shown in Figure 3.
In the course of 3D design and engineering drawing, there are software operations for 3D modeling and generation of engineering drawings, and basic theoretical knowledge of part drawings and assembly drawings, including the selection of views according to part features and manufacturing process, product technical requirements and tolerance fit, expression of process characteristics in part drawings and assembly drawings, etc. The team teaching method divides the contents of each part of the course into modules and arranges different teachers to teach according to different contents. The team of teachers includes engineers with many years of practical engineering experience, senior teachers with CATIA (3D design software) certification, and instructors who have participated in many comprehensive engineering ability competitions, etc., and reasonably arrange teaching based on personal experience. Software teaching is arranged for young teachers who are skilled in software operation and experienced, and for senior teachers with practical manufacturing experience. Through teaching, young teachers can improve their teaching knowledge system, so that they can teach students better in class. Older and more experienced teachers are pushing the envelope in the way they teach. The teaching method of the teacher team realizes the optimal combination and complementary advantages of teacher resources, changes the situation that one teacher was in full charge of a course in the past, solves the problem that the course requires higher comprehensive theoretical knowledge and software operation skills of teachers, and gives full play to the effectiveness of the teacher team. At the same time, teachers' respective advantages make the two-dimensional and three-dimensional knowledge in the curriculum equally important, so that students' learning is easier and the knowledge system is more perfect.

5. Conclusion
Through the specific application of project teaching method in practice, students' interest in learning can be cultivated, and students' practical ability and professional quality can be comprehensively improved, and teaching can serve the society and more qualified skilled talents can be cultivated, so as to meet the needs of the development of engineering project industry. By introducing the project design and case implementation of engineering project related courses, and analyzing the implementation effect of project-based teaching, this paper puts forward improvement measures, which provides operability for project-based teaching and provides reference for teachers' teaching. Teachers can improve teachers' teaching technology and design ability, update teachers' teaching methods and teaching knowledge, and create new ideas. The new skills training mode, teaching methods and teaching evaluation methods have been improved, and the teaching level has been improved.

References
[1] Yuanyuan Qu. Application and Exploration of Project Teaching Method in Environmental Design Teaching. 2020, 3(3)
[2] Li Mingjun, Chen Suhua, Wang Yuehua, et al. Replacement of knowledge points by smart points: innovation of key points for teaching new engineering courses[J]. Research in Higher Engineering Education, 2019, (2): 183–790.
[3] Yang Li, Hao Yuxin, Liu Lingtao. Research on the teaching reform of "Engineering Graphics" course under the background of engineering education professional certification[J]. Journal of Graphics, 2019, 39(4): 786~790.
[4] Lu Guodong, Li Tuoning. Path thinking on the construction and development of new engineering disciplines [J]. Higher Engineering Education Research, 2017, (3): 20–26.
[5] Mu Haozhi, Xue Lijun, Niu Xinghua. Reform and practice of engineering drawing curriculum syllabus under the background of engineering education professional certification [J]. Journal of Graphics, 2016, 37(5): 711~717.
[6] Han Xibin, Cheng Jiangang. The construction and application of learning analysis model based on network teaching platform [J]. Network Education, 2018, 37(7): 33~39.
[7] Huang Yue, Han Xibin, Cheng Jiangang. Mixed teaching reform Analysis of Stage Characteristics and Implementation Effect Deviation[J]. Modern Distance Education Research, 2017, (5): 69~77.

[8] Zhang Zongbo, Wang Min, Wu Baobao, et al. "Online + offline integration" engineering graphics course construction and teaching practice[J]. Journal of Graphics, 2016, 37(5): 718~725.

[9] Xie Jihong, Du Yong, Qu Xiaohua. Research on the "Three-in-one Integration" Teaching Reform of Mechanical Drawing from the Perspective of "Made in China 2025"[J]. Journal of Southwest China Normal University (Natural Science Edition), 2019, 44(8): 139-143.

[10] Xia Li. Investigation and research on the status quo of ordinary high school students' technical drawing ability—based on Nanjing W School [D]. Jiangsu: Nanjing Normal University, 2017.

[11] Wang Li, Zhou Guilin, Huang Yongjie. Exploration of the teaching reform of mechanical drawing course under the background of intelligent manufacturing[J]. Internal Combustion Engine and Accessories, 2019, (18): 283-284.