

Project-Based Teaching Design and Exploration of Comprehensive Surveying and Mapping of Mechanical Drawing

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Abstract. Comprehensive surveying and mapping of mechanical drawing is an important teaching link of combining theory with practice in mechanical specialty. Through the project-based teaching of mechanical parts surveying and mapping, students' surveying and mapping skills can be effectively trained, students' comprehensive application ability of engineering drawing and related basic knowledge can be improved, students' comprehensive learning ability and ability to solve practical problems can be trained, which lays a foundation for the follow-up course learning.

Introduction

Surveying and mapping technology is a general skill in the industry. It plays an important role in machine maintenance, new product design, especially in product imitation, and is closely related to the actual production. Mastering surveying and mapping technology is an important part of students' vocational ability training and the foundation of students' future post development. The course of Engineering Drawing has increasingly strengthened the necessity and importance of training surveying and mapping skills.

Comprehensive Surveying and Mapping of Mechanical Drawing is a highly practical course integrated according to the needs of the industry. It is a comprehensive practice link arranged after systematic theoretical knowledge learning of Engineering Drawing. The aim is to improve students' comprehensive expressive ability of drawings and manual drawing skills. Its teaching process should embody the application and practicality of training objectives.

However, students are not very clear about the purpose of surveying and mapping, and do not understand the role of surveying and mapping technology in the actual production; in addition, the traditional curriculum has a strong flavor, lack of pertinence and practicality, resulting in the separation of "teaching, learning and doing", the decline of students' interest in learning, and it is difficult to stimulate students' learning enthusiasm, which hinders the improvement of teaching quality to a certain extent. Therefore, the practical teaching mode of this course should be improved and innovated in order to cultivate students' surveying and mapping skills and comprehensive application ability, lay a foundation for the follow-up course learning.

Task Analysis of Teaching Process

The Comprehensive Surveying and Mapping of Mechanical Drawing is attached to the course of Engineering Drawing. It mainly exercises and improves the flexible selection of students' standard drawing and parts drawing expression methods. Students should select appropriate measuring tools, map parameters reasonably and process data, master drawing skills and matters needing attention in sketch drawing, choose reasonable expression scheme according to the structural characteristics of parts, write down relevant dimensions and technical requirements in view expression, understand the function of parts' structures from the aspect of technology, and determine technical requirements. It

involves expanding knowledge of tolerance, material, heat treatment, etc. This requires students not only to have a certain knowledge structure, but also to have the ability to access relevant technical information, teamwork and independent analysis of problems and solve problems.

Project-based Teaching Design

Necessity of Project-based Teaching. Comprehensive Surveying and Mapping of Mechanical Drawing is the first comprehensive design course of basic technical courses for students, which is opened at the end of the first semester or the last semester of sophomore year. Students are rather confused, do not know where to start, and lack the ability to solve practical problems. The content of traditional cartography and mapping is scattered, the proportion is insufficient, and the teaching effect is poor. Therefore, based on the teaching content, project-based teaching, typical parts as the carrier and closely combined with curriculum knowledge, the related theoretical knowledge of Engineering drawing, tolerance, material and heat treatment is distributed and infiltrated into various work tasks according to certain rules, so that theory and practice can be integrated together, so as to find the best combination point of drawing knowledge and operation skills. It can help students master knowledge, improve comprehensive application ability, and have a certain space for innovation, so as to enhance the effectiveness of project teaching.

Selection of Project Carrier. In order to ensure the effectiveness of project-based teaching, we should pay attention to the practicability and classicality of parts and components when choosing curriculum project carrier. According to the time arrangement of the teaching plan, gear oil pump is selected as the project carrier for surveying and mapping. Gear oil pump is used to transport various lubricating liquid components. It is not too complicated in structure, but also covers most of the parts: axle sleeve parts (gear shaft, compression sleeve), wheel disk parts (pump cover), box parts (pump body), common parts (gear), etc. Standard parts and their connections (key connection, pin connection, screw connection, bearing), sealing structure, etc. Through the disassembly and assembly of gear oil pump and surveying and mapping, students can understand the working principle of components, assembly relationship, classification of parts, the main structure and shape of parts, processing technology, dimensioning and technical requirements selection of relevant knowledge, and have a systematic overall understanding of the whole course, for freshmen who have just come into contact with mechanical professional knowledge learning. It's more appropriate.

Design of Teaching Scheme. The Comprehensive Surveying and Mapping of Mechanical Drawing is a trinity process of design, measurement and drawing. In the course of establishing teaching projects, we should consider the levels, links and logical relations among teaching projects comprehensively, take "necessary and sufficient" as the principle, closely combine curriculum knowledge, distribute and infiltrate relevant theoretical knowledge into various tasks according to certain rules, and integrate knowledge into each task. Skills, to achieve "teaching, learning, doing" in one. In order to facilitate the mapping of gear oil pump, the project teaching divides the mapping of gear oil pump into three modules: component disassembly, sketch drawing and working drawing, and divides the module into six tasks. Modules and tasks are designed as shown in Table 1.

Organization and Implementation of Project-based Teaching

In the implementation process, the class students are divided into 5-6 study groups, each group has a gear pump, a set of mapping tools, the team leader is in charge. Under the premise of student-centered teaching process, teachers observe, supervise, process control and timely explain in the process of surveying and mapping, and guide students to complete the scheduled tasks step by step.

Table 1 Mechanical Drawing Integrated Surveying and Mapping Module and Work Task Design

Module	Task	Content	Knowledge	Expansion
Component disassembly	Task one Disassembly and assembly of gear oil pump	1. Correctly disassemble and assemble gear oil pump; 2. Draw assembly sketch.	1. Understanding the working principle and assembly relationship of gear oil pump; 2. The gear oil pump will be properly disassembled and assembled. 3. Preliminary understanding of assembly trunk lines, understanding of gear transmission, keys, pins, bearing connections.	1. Consult relevant information; 2. Draw assembly sketch.
	Task two Standard parts measurement (keys, pins, threaded connectors, bearings)	1. Measure standard parts and mark them by code.	1. Parts will be classified; 2. The main dimensions of the standard parts are measured and coded according to the national standards.	1. Selection of Surveying and mapping tools and correct measurement methods;
	Task three Surveying and Mapping of Common Parts (Gears)	1. Mapping common parts and marking parameters; 2. Drawing sketches.	3. Surveying and mapping common parts and related calculations, can draw according to the prescribed drawing method; 4. It can select the measuring tools correctly for surveying and mapping, and process the size data correctly.	2. The technological structure, processing methods and functions of parts.
Sketcher drawing	Task four General parts mapping (pump body, pump cover, gear shaft, gasket, sealing ring, pressing sleeve, pressing nut)	1. Mapping non-standard parts and drawing sketches.	5. Understand the role of parts in assembly and the process structure and use of parts. 6. Understand the drawing steps, precautions and drawing skills of sketches.	
	Task five Assembly Drawing	1. Drawing assembly drawing of gear oil pump; 2. Dimension labeling and technical requirements of assembly drawings.	1. According to the characteristics of assembly structure, the expression scheme of assembly diagram is selected correctly, and the number of views and the expression method are determined. 2. Understand the assembly process structure and express it correctly. 3. The dimension and technical requirements of assembly drawings will be noted. 4. The parts will be numbered correctly and the details will be filled in.	1. Further strengthen understanding of assembly process structure; 2. Understand the selection method of technical requirements in combination with relevant courses such as dimension tolerance, material, heat treatment, etc.
	Task six Drawing Part Drawing	1. Drawing the working drawings of parts; 2. Dimension labeling and technical requirement labeling of part drawings.	1. Correctly determine the expression scheme according to the structural characteristics of the parts; 2. The dimension and technical requirements of part drawings will be correctly noted.	1. Selection of technical requirements in combination with dimension tolerance, material and heat treatment related courses.

In the stage of disassembly and assembly of gear oil pump: teachers can first demonstrate the disassembly process, while presenting the working principle and the function of parts in parts, assembly structure and assembly relationship between parts, so that students can understand the

principle and disassembly process of parts and find the entry point of practical training; at the same time, inspiration questions are given to enable students to participate synchronously, and then students can disassemble and assemble by themselves and discuss with each other.

In the stage of sketch mapping: sketch drawing is the key and foundation. First, students are required to divide the components into standard parts, common parts and non-standard parts on the basis of familiarity with the working principle of components and reasonable disassembly and assembly. It is clear that standard parts only need to determine specifications and code marks according to the main dimensions measured, and only need to draw in accordance with the prescribed drawing method in assembly drawings, without drawing sketches; standard structures in common parts need to determine relevant parameters according to the measured size and make relevant calculations, drawing in accordance with the prescribed method; non-standard parts are the focus of surveying and mapping, and need to draw sketches. Students are required to draw sketches and dimension reasonably according to the structural characteristics of parts.

In the drawing stage of working drawings: in the drawing process of assembly drawings, the expression scheme should be reasonably selected and the problems of positioning, sealing and matching of parts should be fully considered. The size of matching and related dimensions should be corresponded one by one. At the same time, the uncoordinated problems in the drawing process of assembly drawings should be corrected and the parts sketches should be improved in time. When drawing the working drawings of parts, attention should be paid to the size determination of standard parts and standard structures and the reasonable selection of tolerances.

Achievement evaluation: Practical training evaluation should avoid taking students' submission of drawings as the basis of evaluation, and pay attention to students' learning process: that is, focusing on students' comprehensive qualities such as learning ability, analysis and problem solving ability, communication and team cooperation ability in the process of completing surveying and mapping tasks, and doing assessment and evaluation work well by combining process with result evaluation. This requires teachers to have a good idea of each student's performance in the whole training process.

Reform Effect

Through the project-based teaching practice of mechanical mapping integrated surveying and mapping with gear oil pump as the project carrier, the students have a better grasp of surveying and mapping technology, can integrate the theoretical knowledge of Engineering mapping, and integrate it with the relevant knowledge of dimension tolerance, material and heat treatment, improve the students' practical ability, the ability of integrating theory with practice, and cultivate students' comprehensive learning, communication and group. Team cooperation and other comprehensive professional qualities have laid a good foundation for future professional courses.

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