

RESEARCH ON TEACHING PRACTICE IN METAL TECHNOLOGY BASED ON PROJECT TEACHING METHOD

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ABSTRACT

As an important course in the course system of mechanical specialty, Metal Technology plays a very important role in cultivating students' comprehensive ability, ability of integrating theory with practice and practical ability. However, the chapter of "Pressure Processing" of this course is not only heavy and difficult, but also involves many professional terms and abstract concepts. The traditional teaching-oriented "cramming" teaching mode cannot mobilize students' interest in learning, resulting in the lack of active learning and teamwork learning ability. As an important teaching mode to cultivate students' independent learning ability and teamwork ability, project teaching method has been widely paid attention to in engineering education at home and abroad. In this paper, the teaching reform and practice based on project teaching method are carried out based on the objective orientation of "Metal Technology" in the mechanical specialty of our school. Compared with the traditional teaching method, the minimum score and pass rate of students' achievement have been significantly improved after the implementation of project teaching method, and the proportion of project achievement and its proportion in the total evaluation results has been increasing year by year. At the same time, students' innovation ability and team consciousness are enhanced, and teachers' professional quality is greatly improved.

Keywords: Metalworking Technology, Project-based Teaching, Pressure processing, Autonomous Learning Ability.

INTRODUCTION

"Metal Technology" is an important basic technical course for machinery and near machinery majors in engineering colleges and universities, and it is the link between basic courses, practical teaching and specialized courses. This course is to study the production process of products from raw materials to rough parts to qualified parts, and it is the foundation for subsequent mechanical major students to learn the core courses of mechanical design and mechanical manufacturing. It will lay a solid theoretical foundation of materials science for the professional ability required by the future engineering industries such as automobile design, mechanical manufacturing, mechanical engineering, automobile service engineering, material forming and processing other related engineering industries ^[1]. This course is highly practical, closely related to the production and life practice, and has high requirements for students' ability of integrating theory with practice and practical ability. After finishing the course, students can apply theoretical knowledge to solve problems in production and life, and can reasonably select materials by integrating the use performance and process performance of materials, combining with the use environment, economy and other factors, can develop a reasonable heat treatment process, cold processing process to complete the molding process of simple parts customization, can develop a reasonable process sequence

and start processing to complete the metalworking experiment. Through the study of this course, students have the knowledge of parts blank manufacturing and machining technology, and provide technical theoretical support for the subsequent relevant courses study, curriculum design and graduation design.

The course of Metal Technology has two characteristics: First, it has strong comprehensiveness, including the basic metal materials and the cold and hot processing technology. It has many new concepts and terms, complex content, broad scope of knowledge, strong professionalism and limited class hours^[2]. Second, the course is closely related to the actual production, not only classroom theory teaching, but also the implementation of metalworking practice, the two complement each other. Prior to the Metal Technology course, engineering students in related fields are required to undergo several weeks of metalworking practice, which includes lathe workers, milling workers, fitter, sand casting and other content. Through metalworking practice, students can combine theoretical knowledge with field operation of specific mechanical processing technology, be familiar with the general process of mechanical manufacturing, understand the main technological methods and processes of metal processing, and master the ability to choose machining methods and process analysis of simple parts. It plays an important auxiliary role in improving students' comprehensive quality and carrying out the study of Metal Technology for students^[3].

The main learning content of Metal Technology includes five chapters: introduction, casting, pressure machining, welding and cutting, and each chapter contains several teaching emphases and difficulties. Among them, the pressure machining chapter is mainly divided into forging and stamping two kinds of technology. Forging refers to the metal blank in anvil or forging die bore impact force or pressure deformation processing method, divided into free forging and die forging. The process of free forging can be divided into basic process, auxiliary process and finishing process. The basic process includes upsetting, drawing, punching, bending, twisting, staggering, cutting, etc. Die forging can be divided into hammer die forging, press die forging and tire die forging according to different equipment. According to their different functions, the forging die chamber on hammer can be divided into two types: forging die chamber and blank making die chamber, and the forging die chamber can be divided into final forging die chamber and pre forging die chamber; Die forging on press is divided into crank press, friction press and flat forging press. Stamping is a processing method that metal sheet is separated or deformed when pressed between dies. The basic process of stamping can be divided into separation process and forming process. The separation process includes blanking, dressing and cutting. Blanking includes blanking and punching. Their die structure, operation method and separation process are identical, but their functions are different. When blanking, the part flushed down from the sheet metal is the finished product, while the sheet metal itself becomes waste or leftover material. Punching is to punch out the needed holes on the sheet metal. The sheet metal after punching is the finished product, and the part washed down is the waste. Forming process is a process that causes a part of sheet metal to displace from the other part without breaking, such as bending, drawing, flanging, bulging, etc. Punch is an essential tool in stamping process. According to the different process combination, the die can be divided into three types: simple die, continuous punch and compound die^[4]. From the above, the chapter of pressure processing in metal technology is not only focused on many difficulties, but also involves many professional terms and abstract concepts. If the traditional teaching method of "teacher speaking, students listen" is adopted, teachers monologue explain a large number of professional terms and abstract concepts, and students often feel boring and boring, and they don't know the knowledge points deeply, which leads to the rapid decline of learning

enthusiasm. In addition, in recent years, the reform of education system requires all disciplines to reduce the theoretical hours of related courses, which undoubtedly further increases the difficulty of students learning this course. Therefore, in the case of the reduction of the total class hours and the little change of the teaching content, teachers urgently need to change the traditional teaching methods and explore other teaching modes in order to fully mobilize the enthusiasm of students' participation in the classroom, effectively play the subjective initiative of students' extracurricular learning, and let students become the main body of the classroom.

In recent years, project teaching method has been gradually promoted as a major reform of teaching mode in the new period ^[5]. Project teaching method is a teaching activity carried out by teachers and students through the joint implementation of a complete project. Students understand and grasp the knowledge and skills required by the course in the process of project implementation, and cultivate the ability to analyze and solve problems, team spirit and cooperation ability ^[6]. The activity of teachers and students to carry out teaching around the complete project is the project teaching method. When the education and teaching in colleges and universities are carried out, the task of producing a specific product with application value can be called the project ^[7]. Project teaching method can help students to acquire experience and skills from their own experience by organizing students to participate in the design, implementation and management of specific projects, so as to achieve the teaching objectives. Project teaching method is a new teaching method based on students' autonomy and exploratory learning, and adopting similar scientific research and practice methods to promote students' active and active development.

In the project-based teaching activities, "student-centered, project-centered", the teacher is the organizer, director, helper and promoter, who plays the role of "host", and the main teaching work is to promote students to organize processing practice and analysis technology, encourage students to think, discuss and exchange, in order to prevent mistakes and detours [5]. In the process of project practice, students can understand and grasp the knowledge and skills required by the course, experience the hardships and fun of innovation, cultivate the ability of analyzing and solving problems, team spirit and cooperative communication ability. In the team environment, we should give full play to each student's initiative, enthusiasm and creativity, and focus on the process of completing the project rather than the final result. The teaching method with the project as the central goal, through the "project setting - project mobilization - planning - project implementation - process monitoring - project display and defense - project evaluation" such a clear goal, from shallow to deep, step by step implementation process^[8]. The general situation of the project, the knowledge needed for the implementation of the project and the comprehensive solution of the project are presented to the students in a clear hierarchy. This is a kind of teaching method in line with students' cognitive law and learning characteristics, which effectively ensures students' in-depth understanding and accurate grasp of various knowledge points.

PROJECT TEACHING METHOD DESIGN AND TEACHING PRACTICE

A project-driven teaching method was designed according to the characteristics of the pressure processing chapter of Metal Technology. Projection teaching generally includes several modules, such as project setting, objective mobilization, planning, project implementation, process monitoring, project demonstration and defense, and project evaluation.

(1) Project setting: before the project starts, the teacher will decide the project topic and make the group of the project team. In the chapter of pressure processing in metal technology, three

project topics are set for die forging, continuous die (also known as progressive die) and compound die, such as die forging technology and die design for bevel gear friction press, progressive die for punching and cutting off bending, compound die for blanking and deep drawing, etc. Each project team is composed of 5-6 students, and the team leader is elected by the team members to preside over the project work.

(2) Project mobilization: teachers conduct learning mobilization work, so that students can understand the purpose of the project, the ability objectives and specific requirements that the project should be completed, the main knowledge and learning methods needed to complete the project, the project process and assessment methods and other aspects of the content. According to the progress of the course, the teacher will issue the corresponding project assignment, and upload relevant materials and literature.

(3) Develop project plan: First, students independently consult relevant literature and study relevant knowledge, and put forward their own preliminary solution ideas and project work plan; then, the project team formed the overall project solution and key problem solving ideas through full discussion, determined the project plan and schedule, and implemented the division of labor and cooperation within the group. At this stage, each project team will make a report, and teachers will guide students to discuss related problems, and finally form a feasible project plan.

(4) Project implementation: students implement the project content according to the specific tasks in the project plan. During the implementation process, team members are encouraged to communicate with each other, analyze and discuss, and finally form a project report as a unit of the project team. At this stage, teachers should do a good job of guidance and supervision. For the problems encountered by students in the process of implementation, teachers do not directly give answers, but guide students to analyze and discuss problems and solve problems independently, so as to improve students' autonomous learning ability and the ability to analyze and solve problems. The completion of project tasks depends on the division and cooperation of team members. Each member should obey the management of the project team and actively complete individual tasks and the whole project. This kind of project implementation mode with division of labor and cooperation is conducive to mobilizing the enthusiasm of members and cultivating collective consciousness.

(5) Project process monitoring: project quality control is the guarantee for the smooth implementation of the project. In teaching, we can master the project progress and quality control through the project implementation monitoring table. Periodic stage summary is not only conducive to the discovery and solution of problems, but also conducive to the mutual supervision, learning and reference among the groups, so as to promote the competition and improvement among the groups.

(6) Project presentation and defense: after the completion of the project, the project results completed by each project team will be displayed in the classroom, which is convenient for students to communicate and learn from each other, and can also increase the sense of achievement of students. In turn, the team leaders of each project group will report the project and share the learning methods, learning tools and experiences during the project. After the project presentation, the teachers and students will ask questions. All project team members can answer questions. After the defense of the project, the teacher will make comments on the project, point out the places worth learning and reference in the implementation of the project, point out the problems of the project, summarize the successful experience and the reasons for the failure, and finally ask the students to improve the project according to the defense opinions.

(7) Project evaluation: teachers evaluate the quality of the project and give the results of the project team. Teachers' evaluation results are mainly based on the quality of project implementation and the performance of project team defense, with the weight of 50% for each part.

TEACHING EFFECT EVALUATION

Students' final examination scores improved significantly

In this study, we randomly selected 6 classes with similar majors, the same amount of class hours and the project teaching method of metal technology in our school for statistical analysis. Results as shown in Figure 1, taking the traditional teaching method in 2011 as the control group, the lowest score and passing rate of the teaching class have been significantly improved since the project teaching method was carried out in 2014, which shows that the implementation of the project teaching method has significantly improved the learning effect of students. Figure 2 shows the change trend of the project achievement and its proportion in the total score with the development of project teaching method. It can be seen from the figure that the project achievement and its proportion in the total score are increasing year by year, which shows that teachers and students recognize and attach importance to the project teaching method.

Students are active in learning and have broad thinking

The project teaching form based on the realistic design task is relatively new, which arouses the curiosity of students to understand new things, and improves the acceptance rate of the knowledge points of pressure processing based on the autonomy of students' learning. In the practice of project teaching, students have experienced the process of "discovering, analyzing, solving and internalizing knowledge". From the final course papers, students can actively combine the contents of the course and related subjects, promote the mutual penetration of the curriculum and the intersection of knowledge, and lay a good foundation for the follow-up courses.

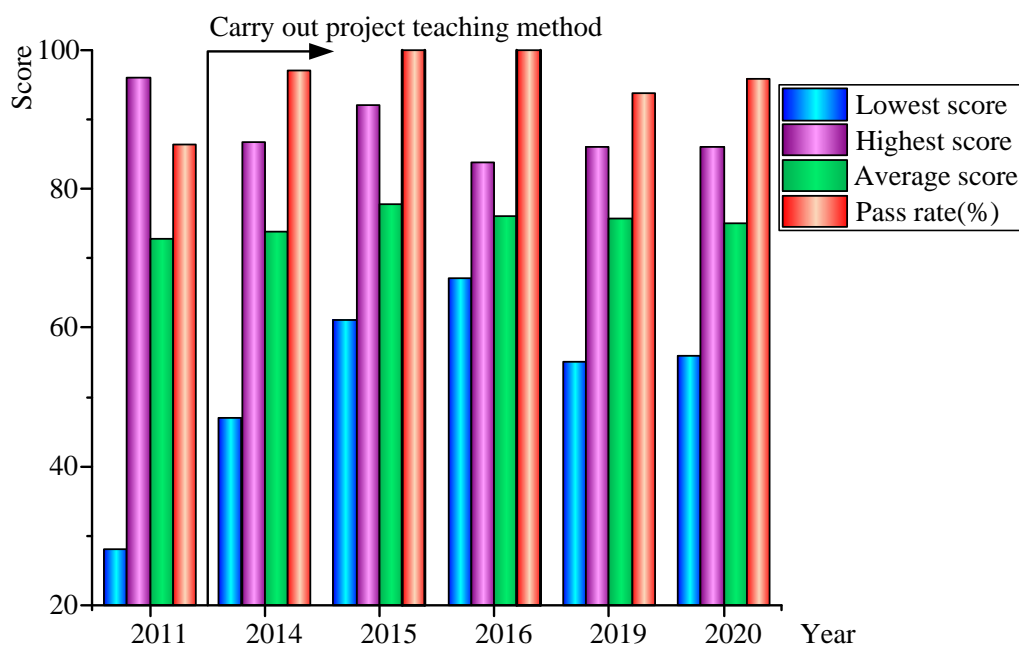


Figure 1. The influence of project teaching method on students' achievement

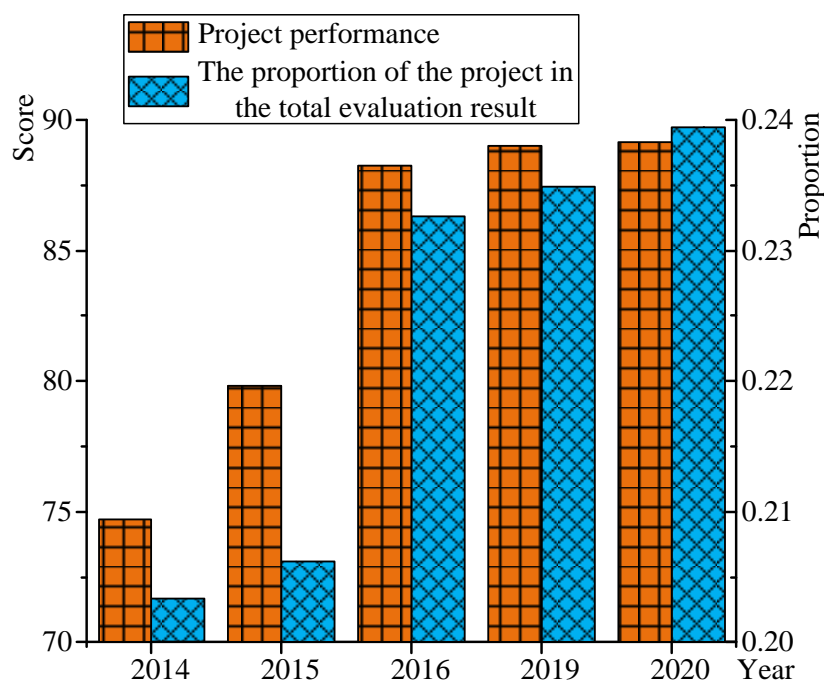


Figure 2. Project achievement and proportion to total evaluation result

Enhance innovation ability and team consciousness

The project is presided over by the team leader, and the team members' work together to complete their own tasks, so as to ensure the overall completion of the project. During the completion of the project, each member will inevitably encounter problems that are difficult to solve. At this time, we need to brainstorm within the group or class to solve the problems together. In the process of mutual cooperation and running in, students gradually sharpen their character edges and corners, reduce mutual accusations and complaints, and imperceptibly cultivate a team spirit.

The professional quality of teachers has been greatly improved

Facing the new and practical teaching mode of project teaching method, in order to meet the students' desire for knowledge and solve the practical problems encountered in pressure processing, teachers must understand the project practice process and be able to solve the common engineering project problems skillfully. This situation drives teachers to improve themselves and strengthen their practical ability on the premise of mastering teaching theory, so as to greatly improve their professional quality.

CONCLUSION

The course of "Metal Technology" is comprehensive, with many key points and difficulties, and there are many professional terms and abstract concepts. The traditional teaching methods cannot achieve good teaching results. By organizing students to truly participate in the design, implementation and management of specific projects, project teaching method enables students to gain experience and skills from personal experience, so as to achieve teaching objectives. Based on the chapter of pressure processing of this course, this paper conducts a practical research on project teaching method for the students majoring in machinery in our school. The results show that: since the implementation of project teaching, the minimum score and pass rate of the class have been significantly improved, indicating that the implementation of project teaching has a significant effect on the improvement of

students' learning effect; At the same time, the proportion of project score and its proportion in the total score is increasing year by year, which indicates that teachers and students recognize and attach importance to the project teaching method.

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