Teaching Reform of *Mold Manufacturing Technology 2* Course Based on the Background of New Engineering

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Abstract. The teaching team has carried out reform and innovation on the course content, teaching method, assessment method and other aspects of *Mold Manufacturing Technology 2*. Based on the new engineering education concept, the training plan and syllabus are revised, the classroom teaching methods are enriched, and the practical ability is emphasized. The teaching process is organized and implemented in a task-driven, project-oriented, group cooperation, and integrated theory and practice approach. A process assessment and evaluation method that focuses on application and highlights ability training has been established. The results show that good teaching effect has been achieved through construction, which provides an effective way for the exploration of applied course teaching reform.

Keywords: Mold manufacturing technology 2 · Teaching Reform · Cooperative teaching between School and enterprises

1 Introduction

In 2017, the Ministry of Education launched the construction plan of "New Engineering", pointing out that "new engineering" should reflect "five new", namely "new concept of engineering education, new structure of disciplines and specialties, new mode of talent training, new quality of education and teaching, and new system of classified development" [1–3], so as to guide the teaching reform of engineering colleges.

The major of Material Forming and Control Engineering in Jianghan University is a national first-class undergraduate major. Based on the background of new engineering and the needs of major construction, the major training plan and teaching syllabus have been significantly reformed. The course reform of *Mold Manufacturing Technology 2*mainly adopts the project-type teaching mode, highlighting the cultivation of students' innovation ability and practical ability, and cultivating students who meet the needs of the new engineering era.

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2 Curriculum Introduction and the Deficiency of Traditional Teaching Mode

Mold Manufacturing Technology 2 is an important professional course of material forming and control engineering, it contains the basic knowledge of CNC machining and special machining of mold parts and typical mold manufacturing process and assembly method. This course takes mold manufacturing and assembly process as the main line, takes into account the knowledge of process equipment and mold manufacturing, and emphasizes the application of new technology in mold manufacturing. The new version of the syllabus requires that on the basis of teaching the basic professional knowledge, the course focuses on teaching the basic methods and skills of using the basic professional knowledge to solve practical engineering problems, highlighting the cultivation of students' innovation ability and research ability. The traditional teaching mode mainly adopts the form of theory course + experiment course. It is carried out in the way of theory teaching, formula derivation by teachers in class and exercise by students after class. Teachers are the subject of teaching and students passively accept knowledge [4–6]. This teaching mode is monotonous in form and boring in content, which is difficult to stimulate students' curiosity and initiative, unable to keep students' enthusiasm for learning, and unable to obtain satisfactory teaching effects.

3 Content of Curriculum Reform

3.1 Training Program Reform

Mold Manufacturing Technology 2 was set up in 2007, aiming at undergraduates majoring in material forming and control engineering, with 1.5 credits and 24 class hours, including 20 class hours for theoretical teaching and 4 class hours for experimental teaching. In 2020, a major adjustment was made to the training program, which was adjusted to 2.5 credits and 60 class hours, including 20 class hours for theoretical teaching and 40 class hours for project training.

3.2 Syllabus Reform

The reformed teaching method emphasizes the close combination of theory and practice, emphasizes the cultivation of students' practical ability, and gives priority to case analysis in class explanation and emphasizes teaching interaction. The course score consists of the process assessment score and the course completion exam score, each accounting for 50%.

In the project-based teaching reform, 7 teaching projects are set up, including 5 classroom practice projects, 1 extracurricular practice project and 1 school-enterprise cooperation training project. The classroom practice projects mainly focus on NC machining and special machining. The extracurricular project involves students working in groups to design and build a small machine. The school-enterprise cooperation training project is to train the programming of mold parts and high-grade machine tools in modern mold manufacturing factories. The process assessment method is shown in Table 1.

Table 1. Process assessment content and target score

	Project	Assessment content and requirements	Scoring criteria	Score	Course objective
1	Learning participation	Students' sense of teamwork and participation in classroom learning	Grade according to class performance. Ime will be disqualified.	10	5
2	Chapter exercise	Complete the exercises at the end of the textbook chapter	The full score is 100 points, 25 points for each section of the assignment, this score is 0, disqualification.	15	1–4
3	Process planning of typical parts	Mold parts process planning considering special machining and NC machining.	The full score is 100 points, 50 points for each process specification.	15	1–3
4	Experimental project	Edm forming parts, wire cutting parts, NC turning parts, NC milling parts, laser cutting parts programming and processing practice.	The score is 20 points out of 100.	20	1、2
5	Practical project	In the group as a unit, in the enterprise CNC machining training, EDM processing training, WEDM processing training and car light mold polishing training. Master mold assembly and adjustment methods.	The score is 100 points, 25 points for each type of training completed.	20	1、2

(*continued*)

Table 1. (*continued*)

	Project	Assessment content and requirements	Scoring criteria	Score	Course objective
6	Small machine making	The team will design and make a small machine in spare time, which is required to simulate the management and operation structure of the company. The division of labor and responsibility of the team members should be clear. The design results will be reported in PPT form by stages, and the works will be displayed at last.	The full score is 100, and the final score will be given by the judging panel in the final presentation. The average score of the group members will be awarded by the judges, and the specific individual score will be awarded by the group leader according to their personal contribution. To form a patent or thesis, add 20 points, with a maximum score of 100.	20	5

3.3 Teaching Mode Reform

3.3.1 Classroom Teaching

Centering on students, the teaching methods of explanation, heuristic, probing and case are selected according to the characteristics of different types of knowledge in this course, so as to stimulate students' interest in active learning and cultivate their ability of independent thinking, problem analysis and hands-on practice. In addition to completing the necessary theoretical learning of process principles and characteristics, students also conduct process planning and programming training in the mode of group work. At the same time, students are guided to apply the basic principles of engineering science to think about how to solve the complex engineering problems in mold manufacturing, including the technical and economic benefits.

3.3.2 Experimental Teaching

The experimental teaching changed the traditional teaching mode, and divided the experiment into 5 projects, which were electric discharge, wire cutting, CNC lathe, CNC milling and laser machining. Each project was explained and demonstrated by the teacher first, and the students were divided into several groups. Each group completed the tasks of

programming and debugging, system interface operation, group work processing and so on, and completed the experiment report.

3.3.3 Cooperative Teaching Between Enterprises and Schools

The practice course has 8 class hours in Wuhan Boyue Mould Co., LTD., which first introduces the company and its production process, and then divides into 4 groups to practice in the production workshop. There are 4 process cycles, each process lasts 1.5 h. In each group, two experienced workers were assigned to guide the students. The process cycles include: CNC machining training, EDM machining training, WEDM machining training, polishing training of car lamp mold, the specific training content is:

(1) CNC machining training.
The introduction of CNC machine tool for mold machining, including machine tool brand, machine tool operating system, machine tool parameters, machine tool processing performance. Explain the operation steps of CNC machining center in detail.
(2) EDM processing training.
The introduction of large numerical control EDM forming machine tool, explain EDM operation steps in detail, including program and parts confirmation, program call, program simulation, table cleaning, etc.
(3) WEDM processing training.
The introduction of large CNC WEDM machine tool, practical operation training of each student includes processing efficiency and quality under different wire speed. The abnormal point of workpiece is analyzed and the optimization method of machining parameters is proposed.
(4) Die polishing training.
The requirements of surface precision, the purpose of polishing, the scope of application and the tools used are introduced. Explain the operation steps of saving die in detail, including clear requirements of die surface finish, saving die and polishing position, fixed saving die, etc. The student enterprise class is shown in Fig. 1.

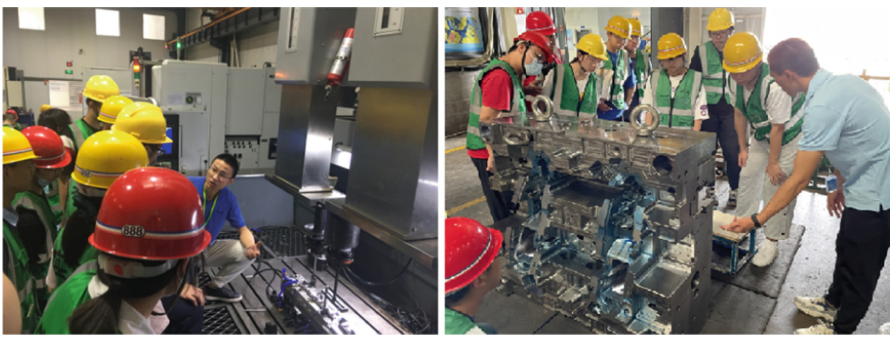

Fig. 1. Student enterprise class

4 The Implementation of Conditional Guarantees

Jianghan University *Mold Manufacturing Technology 2* has a teaching team, including 1 professor, 1 lecturer, 1 senior experimentalist and 1 experimentalist. The teaching team has a wealth of theoretical and practical teaching experience, and is able to teach and guide students to complete the course teaching objectives.

The existing experimental equipment includes: D7140 and Achishimir SE1 EDM forming machine, DK7732 EDM wire cutting machine, 2 CJK6032 CNC lathes, 2 ZJK7532/ ZJK7532A CNC drilling and milling machine, 1 XKF713 CNC copying milling machine, 1 JKX462 laser cutting machine.

The existing training bases of school-enterprise cooperation include: Wuhan Boyue Mould Co., LTD and Wuhan Huayi Meng Mould Technology Co., LTD.

5 Actual Teaching Effect

After a semester of practice, through the summary and questionnaire survey, it is found that the curriculum reform has achieved good results, but there are also some areas to be improved.

5.1 The Results Achieved

Students' teamwork ability has been strengthened. In the group work, most students complete the result very well each time, but there are still a few students who make up the number. Statistics show that 53.42% of the students have dependent thoughts.

(1) Case teaching method has been recognized by students. Data show that 46.54% of students agree with case teaching among various teaching methods.
(2) Cultivate students' awareness of discipline, integrity and intellectual property protection. Students study hard and think it is not easy to score.
(3) By taking a course in the enterprise school, students have a more intuitive and in-depth understanding of the actual production process and operation of the enterprise, and have a more profound understanding of the application of professional knowledge.

5.2 There is Still Work to Be Done

(1) The effect of classroom interaction is not very good. 45.11% of the students were reluctant to participate because of shyness. This is also related to the tradition of Chinese students, and how to change this situation needs to be further studied. 75.34% of the students hoped that teachers would ask engaging questions in class to encourage students to engage in interaction. This is a higher requirement for teachers, teachers should also make more efforts in this aspect.
(2) The performance evaluation method needs to be further improved. 58.9% of the students hope to use in the process of learning to evaluate their grades.

(3) Most of the students hope to increase the practical teaching and practical opportunities, but 60.28% of the students agree with the current way of many people doing experiments together, it is necessary to further explore ways to mobilize the initiative of each student.
(4) 64.38% of the students were in favor of the investigation of memorization, and only 35.62% of the students were in favor of using online search to replace memorization. And the examination of memorization will increase the impulse of students to cheat in the exam.

6 Conclusions

In the reform of this course, a large number of creative reforms have been carried out on the cultivation program, teaching syllabus, teaching content, teaching method, laboratory construction and enterprise classroom construction, and great results have been achieved. The traditional teaching is limited to the single communication between teachers and students in the classroom and books, especially the addition of advanced mold manufacturing enterprises, so that students and teachers have a deeper understanding of mold manufacturing technology and personal practice. It plays a good role in promoting teachers' engineering ability and overall quality. I have a further understanding of the operation, management, production and technological update of the current enterprise, and will combine with the reality in the future classroom teaching to enrich the content. For students, training in different positions in groups enables students to have a further understanding of enterprise operation, management, technology and product types, contact with new knowledge, exercise, and broaden their vision. Through this way of learning, in the training of students' social ability, practical ability, professional quality, employment ability and ability to bear hardships and other aspects have achieved good results. Practice has proved that this is an effective way to strengthen engineering practice, improve professional ability and social cognition ability, and cultivate applied advanced engineering technical personnel. In the future, it is necessary to further explore and practice the operation mode according to the actual problems, and constantly improve it.

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