

# Research on Teaching Reform of Stamping Technology and Die Design\*

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**Abstract**—This paper discusses the current situation of the course reform of stamping technology and die design in recent years, and analyzes the reform of the course's teaching methods and teaching means. The research shows that the teaching method of stamping technology and die design is mainly based on project case teaching, and the teaching means is mainly assisted by software. The research results can be used for reference to the reform of stamping technology and die design and similar courses.

**Keywords**—*stamping process and die design; teaching methods; teaching means; teaching reform*

## I. INTRODUCTION

Stamping technology and die design is an important core course of mechanical major, which is theoretical, practical and comprehensive, thus causing difficulty for both teaching and learning. In teaching, the traditional "indoctrination" teaching method and the conventional teaching means often cannot achieve the ideal teaching effect. In recent years, some teachers engaged in this major or course teaching have carried out beneficial reforms in teaching methods or means, which has improved the teaching effect of the course "stamping technology and die design". The main reforms are described as follows.

## II. RESEARCH ON TEACHING METHOD REFORM

### A. Project-based Teaching Method

The project-based teaching method is carrying on the teaching activity through the implementation of a complete project where the teacher gives students the problems to be solved or tasks to be completed as a project. It is a teaching method where students construct knowledge and skills independently under the guidance of the teacher, with

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students themselves as the center, the improvement of their ability as objective, the project as the carrier and action as the orientation [1].

In the implementation of project teaching, students are generally divided into several groups with free combination or dormitory as the unit. Each group of 5 to 6 people share out the work and cooperate with one another as a team to complete the project, and finally integrate their results into PPT for report and defense. During the assessment, a member of a certain group can be selected by the teacher to explain on the stage, and the teacher can make comments; at the same time, other members of this group can be asked questions at any time by the teacher or students. Students' performance in this part is finally included in their usual grades. Project-based teaching method can not only complete the teaching content and teaching objectives, but also exercise students' expression ability and teamwork ability, which is conducive to create a good learning atmosphere and cultivate students in a comprehensive way.

### B. Error Correction Teaching Method

Error correction teaching is using the wrong cases as students' carrier of learning in which students are asked to find out mistakes or unreasonable aspects and give the correct or reasonable results so as to understand what they are learning. Wrong cases has a strong warning and the enlightenment function, therefore student have more profound understanding to the wrong cases. So error correction teaching can cultivate students' ability to find, analyze and solve problems better.

### C. Phased Summary

In the process of teaching, periodic summary is introduced into the classroom, and every two weeks students are guided to summarize what they have learned. Making a summary is not to simply list what have been learnt, but to put forward the difficulties and things students do not understand in their learning process. The purpose of this is to let students sort out knowledge, consolidate and strengthen, and test their learning effect at any time. In addition, during

the summary, the mind map can be introduced into the classroom to sort out the knowledge logic and construct the knowledge framework. At the end of each class, chapter and semester, students are guided to build a knowledge tree with mind map, connect the knowledge points, form a knowledge network and establish a solid knowledge system [2].

**D. Schoolwork Project Teaching Method**

The schoolwork project teaching method refers to planning three major schoolwork projects according to the three key contents of stamping process. Project 1: simple universal blanking die design; project 2: bending die design; project 3: blanking-drawing composite mold design. The schoolwork projects are completed by students independently with teachers' guidance. Students are required to output complete process materials in each projects. Since the content of the three schoolwork projects covers the main scope of the whole course, the overall assessment results of the three schoolwork projects are the assessment results of

the course. The allocation proportion can be 30% for project 1, 20% for project 2, and 20% for project 3, and these 70% will be taken as the normal grade of the course. In addition, discussion, communication and defense, as the final evaluation results, account for 30% of the course grade [3].

**E. Teaching Method Based on Forming Analysis of Living Cases**

In this teaching method, a concrete example is given for each stamping process. The teacher leads students to do experiments first, and then discuss the characteristics of stress, deformation, influence factors of the quality of work piece, mold structure and equipment, etc. in the forming process of objects, so as to carry out the content of the course based on living examples. The course assessment takes the form of combining hands-on ability, paper test and course design. For example, the teaching process shown in "Table I" is planned according to the module of blanking process and die design.

TABLE I. EXPERIMENT OF CIRCULAR GASKET BLANKING FORMING ANALYSIS

Module Name	Teaching carrier	Experimental project	Learning task
Blanking process and die design	Circular gasket blanking procedure	Project 1: Observing the forming process of circular gasket	Analyzing the characteristics of stress and deformation
		Project 2: Observing the section morphology of gasket under the magnifying glass	Determine the four sections of collapsed corner, bright zone, fault zone and burr of the cross section are determined.
		Project 3: Pressing different materials	Analyzing the mechanical properties of the materials
		Project 4: Do the experiment with different blanking clearance and in different die edge state	Analyzing the influence of the blanking clearance and the cutting edge state of die on quality of cross section
		.	.

**F. Teaching Method Combining Manufacturing and Assembly Process**

Structural design is taught much in the stamping process and die design course, while manufacturing and assembly are taught relatively less. Therefore the combination of the teaching of stamping die structure design with process design makes it easier for students to grasp abstract concepts in learning; process design examples are used to expand students' thinking, mobilize their learning enthusiasm and improve their interest in learning. [5] For example, the issues of assembly technology of punch and punch fixing plate, relationship between die structure and assembly, process design considering die production safety and process design with stock layout in favor of stamping process, etc. can be infiltrated in teaching.

**G. Classroom Interactive Teaching Method**

In the teaching process, the pure "indoctrination" teaching method should be avoided and the interactive teaching method between teachers and students and between

students and students should be enhanced. The question and answer session should be set up in every chapter of classroom teaching [6] to inspire students' interest in learning, stimulate students' active thinking, and activate the classroom atmosphere. The group discussion teaching can also be carried on which divides students into several groups. Full discussion can be carried out between teachers and students and between students focusing on a certain practical question, so as to provide students opportunity for mutual learning and inspiring.

To sum up, the idea of teaching method reform is to change students' passive acceptance into active exploration through projects and cases, that is, to teach them "how to fish". In addition, this enhances the interaction between teachers and students and the mutual communication and learning between students in the teaching process. At the same time, corresponding reforms have also been carried out to the assessment method, which pays attention to process assessment. The purpose of teaching method reform is to train students' engineering consciousness and practical

ability. In this process students' expression ability and teamwork ability have also been exercised, promoting the achievement of knowledge goal, skill goal and emotion goal in teaching.

### III. RESEARCH ON THE REFORM OF TEACHING MEANS

The reform of teaching means is mainly assisted by modern information technology, aiming at cultivating students' interest, and guiding students to practice, verifying or exploring the theoretical knowledge they have learned. The specific reforms of teaching means are as follows:

- Teaching in various means and channels comprehensively: For instance, teachers can display physical stamping parts in daily life (like food plate, kettle, can, computer host shell) to cultivate students' interest in learning; enhance students' perceptual knowledge through disassembly and assembly of molds; make them understand the status of the industry through the opening of professional lectures; implement dynamic teaching through multimedia animation demonstration; guide students to browse the website associated with die or the online course of "stamping technology and die design" to conduct self-exploration; improve students' hands-on skills through school-enterprise cooperation and mold competitions; implement modern design means through the application of two- and three-dimensional software [7].
- Li Gui et al. developed a set of teaching-oriented intelligent design system for the whole process of stamping forming based on NX platform, including stamping process design module, CAE numerical simulation module, mold structure design module and mold motion simulation module. The system takes the whole process of stamping die design as the main line, integrates the basic knowledge and theory of stamping die design, and embodies the whole process of stamping parts from product to process design, CAE analysis and structure design. The system adopts the guided design approach, which is easy to operate and can assist teachers and students to quickly complete the process design and structure design, so that the teaching and practice can be carried out synchronously [8].
- Wang Tiantian applied the finite element simulation software Simufact in the course of "stamping process and die design", made use of Simufact to carry out simulation analysis and intuitive animation display function, and expressed the abstract theory and concept in the process of die design in a very intuitive way. With a more specific, vivid and profound understanding of process setting, defect performance and solution measures, students have improved their learning interest, some difficult problems in the teaching process have been solved and the teaching quality has been effectively improved [9].

- Qin Xianlei et al. designed and developed a fully immersive digital teaching course by use of VR technology. The course includes four functional modules: 1) process demonstration module — displaying the influence of different process parameters on the quality of the work piece in a three-dimensional environment; 2) mold mechanism module — implementing die 360° rotation, scaling, upper and lower die opening and closing, structure and working principle of the display; 3) mold debugging module — carrying out the virtual installation, debugging and trial production of molds by using the equipment established in the three-dimensional environment; 4) special stamping module — enabling students to observe the process of special mold forming up close, including structural cognition demonstration and working principle demonstration [10].

### IV. COMPREHENSIVE REFORM RESEARCH

Xu Jufang pointed out that the key point of teaching reform of stamping technology and die design is setting targets adhering to the mold design and manufacturing professional skills; setting the content adhering to mold design and manufacturing post group process requirements; determining the teaching model adhering to the typical process of stamping process and die design and development; reforming teaching means adhering to the "Internet +" teaching philosophy; implementing dynamic comprehensive assessment adhering to autonomous learning trajectory [11].

### V. CONCLUSION

Through the research on the teaching reform of the course "stamping technology and die design" in recent years, it is not difficult to find that the teaching reform of the course is mainly based on the reform of teaching methods and means; among the reforms of teaching method the project and case teaching is most common, and among the reform of teaching means is mainly teaching assisted by software. In short, the teaching should be aimed at improving students' practical ability, stimulate students' interest in learning, introduce advanced teaching methods, guide students to explore independently, and improve students' ability to solve problems, so as to meet the needs of the mold industry for high-quality application-oriented talents.

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