

# Practical Teaching of "Precision Stamping Die Design Technology" Course Based on Enterprise Tooling Center Projects Operation

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## Abstract

The disadvantages existed in the traditional stamping die practical teaching was analyzed. Combined with the precision products made by Wenzhou regional enterprise, it puts forward the project-oriented practical teaching scheme based on the enterprise real product design project operation, and builds the die and mold design based on the actual project running process in the enterprise tooling center. Process and stratified talent training based on skill division of project subtasks. The practical teaching has achieved a win-win result for schools, enterprises and students, and the effect is remarkable. It provides valuable experience for engineering professionals to conduct real-production oriented project capability training for enterprises and vocational education institution.

## Keywords

Enterprise Project, Practical Training; Team Division; Talent Training; Mold Design.

## 1. Introduction

With the continuous deepening of the reform of higher vocational education and the gradual improvement of the social skills requirements for applied talents, the curriculum requirements of higher vocational colleges can be consistent with the job skills needs and real work patterns of enterprises, and classrooms are the practical shop is unified, the production and practical training are combined, and the course practical case and enterprise project research are combined. As the core technology and equipment of modern manufacturing, stamping die and mold occupy a very important position in enterprise production. In recent years, the rising labor cost and the continuous advancement of intelligent manufacturing technology, the degree of automation and intelligence of enterprises has been continuously improved, and its skills and quality of talents have risen to a new level. However, the stamping die and mold is a wide connotation industry, and its technical nature is closely related to the specific formed products. According to the material of the product, the die and mold can be divided into a plastic molding mold and a metal forming die; according to the molding process of the product, the mold can be divided into a cavity filling mold and a pressure forming mold; according to the molding temperature requirements, it can be divided into normal temperature forming molds and high temperature molds; according to the degree of automation, molds can be divided into manual molds and automated molds. As a mold for punching, bending or stretching the force applied to the metal plate at a normal temperature, the stamping die is widely used in automobiles, electrical appliances, meters, and so on. However, due to the large difference in the dimensions and precision requirements of the metal stamping parts of automobiles and electrical instruments, the die and mold structure and design method are almost completely different, which brings complex diversity to the theoretical teaching and practical training of stamping dies. After completing the corresponding stamping process and stamping die design courses,

students still do not have the ability to directly design and manufacture molds for stamping parts.

Wenzhou Vocational and Technical College has always adhered to the close integration with the regional economy in the process of running the school. It is aimed at the provincial-level demand for mold industry production in Wenzhou. It is oriented to Wenzhou China's low-voltage electrical appliance capital, precision electrical appliances, instrumentation hardware connectors in low-voltage electrical appliances and automobiles. Electronics are characterized by a very important proportion in the regional economy. Wenzhou Vocational and Technical College highlights the intelligent continuous stamping die design and manufacturing job skills training for small and medium-sized precision metal parts in the core course of the mold professional "Precision Cold Die Design Technology". In the talent training program, according to the student's interest and the actual needs of the enterprise mold technical talents, the professional talents are trained in different levels and in multiple directions. In this paper, Wenzhou professional technology in the "precision cold die design" comprehensive training course in accordance with the successful practice of the actual operation mode of the enterprise to share experience, explore the mold professional training of technical design talents and skills-based mapping, manufacturing talents comprehensive practical training course reform.

## **2. Disadvantage in Traditional Stamping Die Design Practical Teaching**

### **2.1. The Mismatch Between the Practical Formed Products and the Products Produced by Wenzhou Regional Enterprises**

The traditional stamping die design products are out of production practice, and the stamping products and their corresponding die designs exemplified in the teaching process have lagged far behind the actual production of enterprises in Wenzhou. The company's real automated precision stamping die design process and technical means unable to be reflected in the existing teaching. As a result, students are still not able to effectively adapt to the company's automated molds after learning the relevant stamping process and mold design courses. It also takes a long time to run in the enterprise tooling center project or special mold company.

### **2.2. The Mismatch Between the Course Practical Training Design Method the Actual Operation of Wenzhou Enterprise Project**

Since the conventional stamping die is a single-process die and a composite die, the production process is mainly manual feeding or semi-automatic feeding. The mold design method, design method and automatic precision progressive die design are quite different. The die structure, sheet feeding and positioning guiding mechanism are completely different from the automated progressive die.

### **2.3. The Mismatch Between the Course Practical Training Process and the Wenzhou Enterprise Design Actual Process**

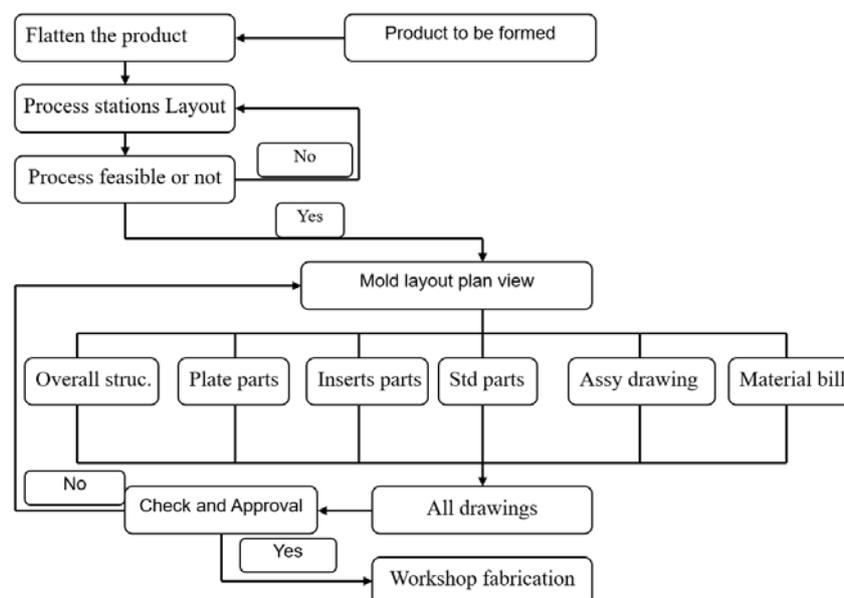
The traditional mold design is usually drawn by AutoCAD according to the assembly drawing of ordinary machinery. It is simply a substitute for manual painting. It does not make full use of the powerful layer drawing function of the software, nor does it use the mold developed by the mold industry. Dedicated design software module. The direct result is that after learning the simple stamping die design, students can't run relatively complex progressive die design and manufacturing optimization work in the enterprise tooling center project. Students can't complete a mold that fits the company's production in a three-week course design.

## 2.4. The Mismatch Between the Course Two-Dimensional Structure Diagrams and the Actual Assembly and Debugging of the Enterprise

The traditional mold structure diagrams are all consistent with the general mechanical assembly design, without considering the particularity of the mold industry. After the mold structure design is completed, in the mold drawing and manufacturing, students and mold makers are required to have a very high spatial imagination, in order to complete the assembly drawing of the mold parts and the overall structural assembly of the mold. In the assembly and debugging of the mold, it is often necessary to modify the fitter due to the unclear details of the local details, which lengthens the mold development cycle.

## 3. Practical Teaching Process Based on the Real Project Operation in Enterprise

Die and mold as the core process equipment for production, usually obtained in two forms, one is ordered from professional mold manufacturers, designed and manufactured by professional mold manufacturers; the other is large group-type enterprises, due to the large demand for molds, usually The group has a centralized mold center, which is responsible for the mold production needs of the Group's production units. For small-sized hardware functional stamping of low-voltage electrical connectors and automotive electronics in Wenzhou, molds are usually organized and manufactured in the form of mold centers. Due to the small overall size and high precision requirements, the production parts are basically produced in the form of automated progressive molds. The mold station can vary from several stations to dozens of stations according to the complexity of the parts. It can complete more than ten sets or even dozens of sets of ordinary single-step stamping dies in one mold. In addition, the progressive die enables high-speed stamping with extremely high production efficiency.



**Figure 1.** Die and molding design diagram under the enterprise projects operation

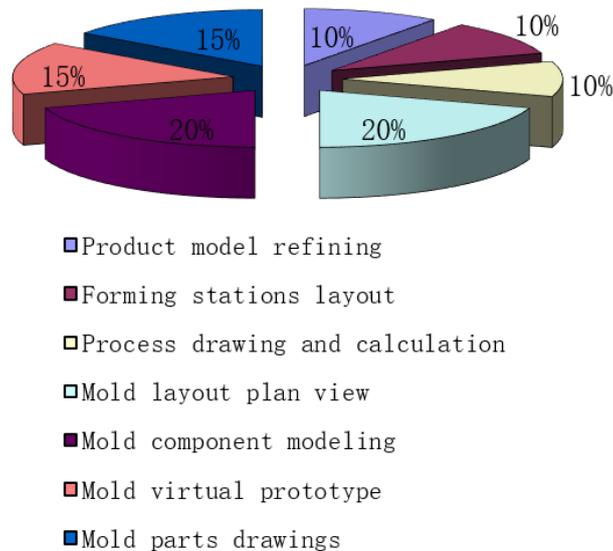
In view of the high precision of stamping parts and high degree of mold automation in Wenzhou, Wenzhou Vocational and Technical College will reform the comprehensive training course of stamping die design, and position the mold parts products as hardware and electronics contact pieces originating from local enterprises. The stamping die is positioned as an automated progressive die, and the teaching organization and management of the project training is

carried out according to the operation mode of the enterprise tooling center project. The detailed comprehensive practical training process is as follows:

- (1) Collecting metal stamping parts products from Wenzhou related hardware and electronic appliances company, sorting and transforming according to the actual conditions of teaching, and transforming them into teaching projects of stamping die comprehensive practice;
- (2) The comprehensive training project must integrate most of the knowledge and skill points of the stamping process, and the knowledge and skill points of discrete blanking process, bending process, drawing process and mold structure components, in the form of progressive die design projects. Integrated and integrated. The overall outer dimensions of the mold must be able to be seamlessly integrated with the company's real punch, achieving compatibility with punching force, mold mounting and closing height;
- (3) Students follow the schedule and task assignment of the operation of the enterprise tooling center project to carry out part layout and structural design. In the design process, summarize and review, optimize the real project development process such as improving mold layout and structure, and strengthen the application and improvement of basic knowledge in the operation and operation of the enterprise tooling center project;
- (4) After the design is completed, create a 3D model of all non-standard parts and detailed 2D engineering drawings and develop a manufacturing and processing plan. Based on the equipment technical capability specifications of the college metalworking training center and the enterprise mold workshop, a theoretically correct and operationally feasible manufacturing process is formulated. Through the task division and stage review of the mold center mode, students will develop core skills such as real mold design positions, part modeling and drawing positions, and manufacturing process development positions.

In accordance with the team's small-component workmanship and mold manufacturing economic requirements for mold design run by the enterprise tooling center project, the students should focus on cultivating students' knowledge and professional skills in the project training. Specifically include:

- (1) Applying the knowledge of stamping forming process and the continuous stamping characteristics of progressive die, designing the nesting and economic calculation of the material in the strip.
- (2) Emphasis on the structural safety of the high-speed progressive die in the mold design, requires students to consider the appropriate empty work station between the stations in the layout design of the products to enhance the robustness of the die and mold structure.
- (3) In the mold design, profoundly comprehend and apply the modern manufacturing technology of the mold and the management concept of saving manufacturing cost. In the mold design, the die is designed as a block as much as possible, saving expensive materials and simplifying the processing of the die.
- (4) After the mold structure design is completed, the three-dimensional computer aided software is applied to carry out three-dimensional modeling and assembly, and the local details in the two-dimensional structure design of the mold are modified to reduce errors in mold assembly and debugging.
- (5) Digitalized number all the components of the mold, promote the centralized management of the mold during the manufacturing and use process, and integrate with the overall information system of the enterprise.



**Figure 2.** Students Subtasks Based Enterprise Tooling Center Projects Operation Cycle

In the process of comprehensive training, combined with the actual work process, job skill requirements and individual characteristics of the students in the operation of the enterprise tooling center project, a level of training and education is carried out.

For students with good foundation and strong innovation ability, focus on cultivating stamping process layout and mold structure design; for students who are diligent, patient and patient, focus on the preparation of 3D modeling, virtual assembly and engineering drawings;

For students with poor design foundation and strong motivation, focus on cultivating students' virtual assembly, real assembly and bill of materials preparation. According to the task assignment required in the process phase of the operation of the enterprise tooling center project, the tasks of the students are mapped, the diversification of similar products and layout methods are decomposed, and economic indicators and structural optimization indicators are formulated.

In the comprehensive training process, the project students are required to comprehensively analyze and compare the effects of similar products and various layout methods on material utilization rate, structural complexity and manufacturing cost, and realize them by using two-dimensional and three-dimensional CAD software. Classmates discuss each other and review each other, that is, learn from each other, and guide and supervise each other. That is to complete their own tasks, but also to learn the advantages of others, the shortcomings to give pointers, to the teamwork spirit of the enterprise tooling center project team to complete the mold design.

In the mold training process, according to the student stage tasks and division of labor, all parts of the project are rotated. Each student must complete the tasks he undertakes, and actively participate in the discussion and review of other students' tasks, and check and improve the reviewed project drawings. The monitoring of project implementation adopts the three-trial system of student group mutual evaluation and mutual review, instructor review, and enterprise tooling center project operation expert review, which effectively guarantees the design quality and provides guarantee for the mold to face the manufacturing design and reduce the production cost.

## **4. Practical Teaching Achievements Based on the Real Project Operation in Enterprise**

Since the mold parts are real enterprise small precision electromechanical hardware, the mold realizes continuous automatic stamping production on the standard punching machine of the enterprise in an automated manner, which is completely consistent with the real enterprise stamping production, effectively overcoming the traditional single-process manual mold. Differences in design methods and mold structures. During the mold design process, the technical support and manufacturing process review of the enterprise tooling center project operation were also obtained, which enabled the students to fully compete for the operation of the enterprise tooling center project after comprehensive training. Based on the comprehensive training of stamping die design in the operation mode of enterprise tooling center project, it effectively overcomes the lack of design training of traditional simple stamping die, and better promotes the integration of school and enterprise, school training classroom and enterprise tooling center project operation. Achieved the purpose of achieving teaching, training and technological progress, summed up the training results of the mold center as follows:

### **4.1. Students Learned the First Hand Experiences for the Automated Progressive Die and Mould Technology**

Through the layout and mold design of precision metal parts originating from the enterprise, students are familiar with the design process and related knowledge skills of real automation precision progressive molds. In the process of formulating and judging the mold manufacturing process in the enterprise tooling center project, students can combine their own career development planning and intentional job ability requirements, learn professional knowledge and rigorous and serious from the operation process of the enterprise tooling center project operation.

### **4.2. The Practical Training Achieved Drawings Can Be Improved and Filtered By the Technical Supervisor of the Enterprise and Used Into the Shop Production**

The better design drawings in the training can be manufactured and assembled in the enterprise tooling center project, and the automated trial production is carried out by the enterprise stamping workshop. From the perspective of technical talent training, the mold-oriented molds are trained during the implementation of the training project. Structural design positions, mold-oriented modeling and mapping jobs, and mold-oriented assembly and manufacturing positions can directly correspond to mold designer, mold drafter and mold manufacturing assembler positions in the enterprise tooling center project.

### **Conclusion**

The stamping die design practical teaching training of the operation mode of the enterprise tooling center project combines the basic stamping process and theoretical calculation of punching, bending and drawing of cold stamping. At the same time, according to the mold design and manufacturing method of the enterprise automation progressive mold, the mold design is organized, and the integration degree of the mold comprehensive training product and the regional industrial product is enhanced, and the corresponding mold design, drawing or manufacturing assembly of the mold center is carried out after the graduation. Job work provides a real working environment. In the comprehensive training, the job skills of different positions in the operation of the enterprise tooling center project and the interest and technical level of students at different levels have been strengthened accordingly. Most of the students have improved their ability in mold design and manufacturing process. . Practice has proved that the comprehensive training of the project mode of the enterprise tooling center project is

in good agreement with the actual job position of the students after employment, which reflects the goal of training talents in different levels and in multiple directions, and has achieved a win-win situation among schools, enterprises and students. A happy ending.

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