

# Experimental Reform of the Open Course of Engineering Materials and Forming Technology for Students

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**Abstract:** This paper analyzes the disadvantages of the traditional experiment of "Engineering Materials and Forming Technology Basis", and introduces the ideas and practices of the experimental teaching reform and practice of "Engineering Materials and Forming Technology Basis". By using multimedia teaching means to build an experimental platform, strengthen the teaching of production cognition, open laboratories, add comprehensive experiments, establish student guidance system and other comprehensive means, It not only improves students' interest in learning and ability to solve practical problems independently, but also shortens the distance between classroom teaching and production practice, which provides some effective methods and approaches for exploring the training mode of applied talents to meet the social needs.

**Keywords:** Open experiment, Engineering materials, Reform in education.

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## 1. Status Analysis

"Foundation of Engineering Materials and Molding Technology" is a major professional basic course of mechanical engineering in colleges and universities. The task of this course is to clarify the basic theories of engineering materials and molding technology from the perspective of their basic application. Make students understand the relationship between chemical composition, processing technology, microstructure and properties of materials, This paper introduces the basic knowledge of commonly used engineering materials and molding technology foundation and application, so that students can have the preliminary ability to reasonably select materials and correctly formulate parts processing process routes and process specifications according to the service conditions and performance requirements of mechanical parts on the basis of mastering the basic theoretical knowledge of engineering materials and molding technology foundation. Therefore, students are required to combine theoretical knowledge with practical engineering, but it is difficult for them who have only conducted engineering training. As the link and bridge between theory and practice, the experimental teaching of engineering materials and molding technology foundation is an indispensable teaching link to cultivate students' engineering awareness, practical ability and practical ability. Therefore, how to improve the experimental teaching quality of this course has always been a common concern of teachers. Aiming at the problems existing in the experimental teaching of this course, this reform explores and practices the teaching reform in the aspects of teaching content, teaching methods and laboratory construction.

## 2. The Problems to Be Solved

For a long time, the basic experiment course of engineering materials and molding technology in our school has been based on the requirements of the teaching plan, and two experiments are both confirmatory experiments. Usually,

students don't preview before the experiment, and they don't go into the laboratory to know the experimental equipment in advance. Before the experiment, teachers prepare the experimental instruments and experimental samples in advance. Then, students conduct experiments according to the contents, operation methods and experimental steps specified in the experimental instruction book. After the experiment is completed, students can complete the experimental report. Because it is a confirmatory experiment, the experimental results are the same, which leads some students not to do the experiment or copy the experimental report. In addition, the number of students is large, the hours are small, the experimental equipment is old and the number of sets is small. As a result, schools, teachers and students all pay little attention to experimental teaching, and regard experimental class as a subsidiary of theoretical class. This teacher-centered approach gives students little opportunities and space for autonomous learning, and does not stimulate students' desire for innovation. They only passively accept the experimental process and results designed by the teacher. It is difficult to achieve good teaching effect, not only can't adapt to the modern talent training mode, but also can't play an active role in cultivating students' practical ability, ability to analyze and solve problems, innovation ability and improving students' comprehensive quality. Therefore, it is imperative to reform the basic experimental teaching of engineering materials and molding technology.

## 3. Basic Contents of the Project

(1) Open the laboratory before the experiment. In the past experiments, students came to the laboratory with the experimental instruction book, listened to the teacher's introduction to the experimental contents and steps, and then conducted the experiment according to the requirements of the experimental instruction book. What equipment to use and how to operate the equipment were completely explained by the teacher, which led to the students' dependence psychology, and they didn't preview before the experiment, and only studied according to the experimental instruction book after

previewing. Even after the operation, they soon forgot, which did not arouse their interest and initiative. In addition, the experiment of "Engineering Materials and Forming Technology Basis" is relatively concentrated, and the usual experimental equipment is idle, and it is often not enough when in use.

(2) Tutorial system. Select students who have a serious and active learning attitude and a certain ability to organize and call as team leaders, and play the role of management responsibility.

(3) Construction of experimental platform. In order to increase students' interest in experimental courses, expand students' professional vision, establish a laboratory website, and display the development of "Engineering Materials and Forming Technology Basis", the preparation, organization and heat treatment process of typical materials, the principle and usage of material analysis and testing instruments, etc. through network courseware.

(4) Reform of experimental content. Usually, the experimental arrangement is carried out one by one according to the progress of theoretical lectures. The experimental content is the verification of this part of theoretical knowledge, and students can only understand the partial content, without forming a complete system for the whole course.

#### **4. Project Implementation Plan**

(1) Open the laboratory before the experiment. In the past experiments, students came to the laboratory with the experimental instruction book, listened to the teacher's introduction to the experimental contents and steps, and then conducted the experiment according to the requirements in the experimental instruction book. The teacher completely explained what equipment to use and how to operate the equipment, which led to students' dependence. Before the experiment, I didn't preview it, but I just studied according to the experimental instruction. Even after the operation, they soon forgot, which did not arouse their interest and initiative. In this reform, the laboratory is opened in advance before the experiment. Students can preview the experimental contents in the laboratory according to their own time schedule, understand and master the principle and structure of the experimental equipment, preliminarily master the operation steps of the equipment, consult the data, work out the experimental scheme and write a preview report. Only after being signed by the experimental teacher can you enter the laboratory for experiments.

(2) Tutorial system. The basic experiments of engineering materials and molding technology are relatively concentrated, and the usual experimental equipment is idle, which is often not enough when it is used. Due to the large number of students, teachers can't guide the centralized experiment, which leads to fewer hands-on opportunities for students or insufficient mastery of the experimental purpose and equipment operation. Coupled with the opening of the laboratory before the experiment, It takes enough time for students to preview, which greatly increases the workload of teachers. In view of this situation, the tutorial system is adopted in the experiment process to solve the problem of less tutors. Specifically, in the class, first divide the students into several groups, and each group selects a student who is serious in study, good at communication and willing to contribute as the leader. Before the experiment, the teacher first taught the teaching contents to these students, including the preparation of the experiment, the steps of the experiment

and the operation of the equipment. Then, the group leader led the group members into the laboratory to preview, and worked out reasonable and feasible experimental steps to complete the preview report. When doing the experiment, each group conducts the experiment separately, and the group leader and the instructor guide the students to do the experiment together. Make every student's practical ability fully exercised.

(3) Construction of experimental platform. In order to increase students' interest in experimental courses, expand students' professional vision, establish a laboratory website, and display the development of "Engineering Materials and Forming Technology Basis", the preparation, organization and heat treatment process of typical materials, the principle and usage of material analysis and testing instruments, etc. through network courseware. In addition, Carefully arrange the display exhibits in the laboratory, such as adding some gears and tools that have actually been tested for hardness, bearings with different heat treatment processes, metallographic organization charts of typical materials, engineering objects with various failure forms, etc. Establish experimental platforms of various forms of teaching, enhance students' perceptual knowledge of materials and improve students' interest in learning. In addition, In view of the difficulty that only one person can observe the metallographic structure on the microscope, which is not convenient for demonstration, explanation and analysis, the laboratory can build a digital network microscopic interactive laboratory. Teachers can operate the microscope on the teacher's side, and directly demonstrate the observed tissues on the big screen or on the student's side, so that students can easily understand the experimental contents. This avoids the disadvantages of previous teaching methods.

(4) Reform of experimental content. Usually, the experimental arrangement is carried out one by one according to the progress of theoretical lectures. The experimental content is the verification of this part of theoretical knowledge, and students can only understand the partial content, without forming a complete system for the whole course. In particular, "Engineering Materials and Forming Technology Basis" emphasizes the relationship between materials-process-organization-performance. In a single experiment, organization, process and performance are separated. Students are at a loss when doing experiments, and they don't know the reason for doing so. The analysis of experimental results in the experiment report is not satisfactory. In view of this situation, We can change and expand the experimental content, and improve students' application ability of analyzing and solving problems. For example, first, the design is used in different environments and a certain type of microstructure is required. Students are required to select materials by themselves, and carry out heat treatment process, hardness test and preparation and observation of metallographic samples. 6~8 students in a group, After getting the task, go to the laboratory to preview under the leadership of the team leader, get familiar with the experimental process and equipment, consult the data, formulate the experimental scheme, complete the preview report and submit it to the teacher to check whether it is reasonable, and if the scheme is reasonable, allow this group to enter the laboratory to start the experiment. During the whole experiment, the operation of heat treatment furnace, hardness tester detection, preparation of metallographic specimen, Metallographic observation and photographing are all done by students themselves, and

finally the experimental report is completed, which further deepens the impression of the relationship among process, structure and performance. In addition, students can be organized to exchange and discuss the experimental results of each group. Students with interest and ability can also be organized to participate in the competition of Dachuang and Metallographic Organization, and teachers can also be assisted to complete scientific research tasks. Further deepen the talent training of "deep integration of science and education".

## 5. Conclusion

1) Opening the laboratory allows students to preview the experiment in advance, be fully familiar with the operation and steps of the experiment, and clearly know the difficulties and key points of the experiment, that is, know fairly well, which increases their confidence in doing the experiment.

2) Through the tutorial system, the team leader can lead the team members to experiment, which enhances the sense of responsibility of these students, and at the same time reduces the workload of teachers, which is beneficial to the management of the laboratory. In addition, they are familiar with each student's situation, and the students also feel trust and kindness to them, without generation gap difficulties and fear, and coordinated management by them can be more effective and convenient.

3) Let students independently consult the data and independently design the experimental scheme until the experiment is completed and the experimental report is written, which comprehensively trains their self-study ability and hands-on ability, and at the same time broadens their professional vision and greatly stimulates their interest in learning. The display and evaluation of the experimental

results of each group enhanced their sense of competition and team spirit.

4) In the course of the experiment, it is inevitable that students will encounter various problems. Students have learned to try patiently and repeatedly or consult data again to solve them, which is quite different from the previous experiments. Their ability to analyze and solve problems independently has been greatly improved.

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