

# Suggestions on Teaching Reform of Lathe Work Practice in Engineering Universities

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**Abstract.** Lathe work is the most representative basic manufacturing method and its practice is a required professional course in engineering universities. By learning lathe work practice, students can master mechanical machining operation skills and cultivate innovation consciousness. This paper analyzes the present condition of lathe work practice and presents some suggestions on teaching reform. Based on the suggestions, teaching reform brings significant improvement on students' comprehensive abilities.

## 1. Introduction

The basic principle of mechanical machining is that relative motion of tool and workpiece in metal-working machine removes excess metal material from workpiece and meets the requirement of shape, size and surface roughness. Lathe work, drilling, milling, planning and grinding are main processing methods. Lathe work uses the rotation of workpiece and the linear motion of tool to cut workpiece, which is the most representative manufacturing method [1]. As a basic practice course, lathe work practice is essential for students majoring in mechanical engineering to study professional courses such as engineering materials and fundamental of mechanical manufacture. It is also an important practice teaching link in teaching plan of non-mechanical engineering. The purpose of lathe work practice is to let students understand the processing technical process of typical lathe parts and master essentials of lathe operations and general knowledge of safety production. In students' ability cultivation, lathe work practice can train the ability of theory with practice, cultivate innovative consciousness, improve comprehensive practice abilities and establish right labor intensity [2].

## 2. Present condition analysis of lathe work practice teaching

### (1) Features of lathe work practice

With strong practicality, lathe work practice has high technical requirements and is hard for students to master relatively. Lathe work practice involves wide range of theoretical knowledge such as principle of mechanical machining, basic forms of processing, the range of lathe work, main structure and function of lathe, types and function of lathe tool. Students are required to master many skills and knowledge such as reading drawings, analyzing the process flow, tool angle sharpening, lathe operation flow, basic principles of safe operation. Referring to production management of enterprises, the practice process simulates actual production process, including plotting, reading drawings, analyzing process, producing process cards, machining, measuring and test.

### (2) Teachers' uneven comprehensive professional quality.

Generally, older teachers master operation but lack systematic theoretical knowledge. Young teachers are good at systematic theoretical knowledge but lack operation experience. Taken as a whole, teachers lack work experience of enterprises and the comprehensive professional standards still need to improve. In practice teaching, the methods and contents teachers use are often laggard and single. The lack of interests causes students can hardly focus all attention to practice, which influences the quality of teaching.

### (3) Low-grade students

As a part of metalworking practice, lathe work practice is mainly for first-year students majoring in engineer. Because the students always study theoretical knowledge and lack practical experience before lathe work practice [3], they may be not interesting in lathe work practice and don't value practice, which easily arouses students' perfunctory behavior [4]. All these factors may cause security accidents and personal injury.

### (4) Single evaluation criteria of student score

The evaluation criteria of student score is too single to fully reflect students' performance in the whole process. By learning lathe work practice, students can master basic skills of lathe work and methods of planning processing technic, enhance the ability of solving practical problems and develop a good professional quality. However, current evaluation of student score overemphasizes the quality of machined parts and decides the score based on the parts [5]. Because students' performance in the whole process is ignored in current evaluation criteria, students easily lose focus in operation and generate negative emotions, which be harmful to improving teaching quality.

## **3. Suggestions on teaching reform of lathe work practice**

From the above analysis, there are a few problems in lathe work practice teaching such as hard practice content, teachers' uneven comprehensive professional quality, lack of students' interest in practice and single evaluation criteria of student score. In order to solve the problems, based on authors' practical teaching experience, some suggestions on teaching reform are presented in order from start to end as following:

### (1) Arousing students' interest in mobilization meeting

Arousing students' interest in practice is beneficial to ensure normal practice teaching and improve teaching quality. Students' curiosity can be used to arouse study interest. Before practice, a two-hour mobilization meeting is prepared to introduce brief information of lathe work, detailed time and arrangement, score criteria, introductory theoretical knowledge of lathe work and safety education. In the mobilization meeting, teachers should use various methods to arouse students' interest, for example playing numerical control machining videos, explaining basic knowledge of lathe with videos and cartoon, introducing rules and basic principles of safe operation in practice process with PPT files [6]. Students have studied theoretical knowledge for long time and are full of curiosity and thirst for practical knowledge. Most of them are interested in the various ways and glad to work hard in practice.

### (2) Implementing three patterns in practice

Three patterns in lathe work practice includes classification of practice projects, productization of project training, humanization of teaching management. Implementing the three patterns can better build theoretical knowledge system of lathe for students, enhance operational ability and safety consciousness, strength product quality awareness, which is good for improve students' comprehensive practical abilities and establish right labor intensity. The detailed content is as following:

#### ① Classification of practice projects

The classification includes theory or practice, easy or hard, sectional or comprehensive. For example, theoretical knowledge covers machining principle, range and features of lathe work, classification and specifications of main machines, structure and function of major components, classification and function of common tools and fixtures. Practical skills cover basic operation procedure of lathe work, using and reading vernier calipers, preparation and regulation of safe operation, reasonable selection and installation of tools and so on.

#### ② Productization of project training

Reference to vocational education experience in developed countries, skills that students need to train are composed into various kinds of projects and products. While completing the project, products are also manufactured by students, which can bring students accomplishment and arouse study interest. Since projects are taken as products, the selected processing technics, methods and

man-hour should meet the requirement of product manufacturing as well as possible [7]. In the process of comprehensive project training, students are required to operate machines independently and accept examination [2].

### ③ Humanization of teaching management

Different from other experimental lessons, lathe work practice has a certain degree of risk. Generally, a teacher needs to manager many students and the enterprise management model can be employed to restrict students' behaviors effectively and ensure their safety. However, the enterprise management model also inhibits students' initiative and reduces participation. So, humanization management is used to make atmosphere lively. On the premise of ensuring safety, teachers give students enough freedom and encourage excellent students help others.

#### (3) Improving teachers' comprehensive professional quality

For teachers' uneven comprehensive professional quality, communication should be often organized between inexperienced and experienced teachers. Teachers should be also encouraged to attend various training to enhance teaching ability.

#### (4) Setting reasonable teaching arrangement

In the study of principle of mechanical machining, teachers should explain the content while operating lathe. Students can see the change of shape, size and surface roughness of workpiece intuitively [8]. Before operating lathe, students should preview necessary knowledge and operation regulation. Then students are required to explain how to operate lathe. In the test of reading vernier caliper, teachers can divide every two students into a group. One student has the examination of reading vernier caliper. The other has the examination of regulations.

#### (5) Building comprehensive evaluation criteria of student score

Some important information should be told in mobilization meeting, for example the practice is a compulsory course and can only be retaken without make-up examination. The grades include excellent, good, average, pass and fail. Original examined content is retained. Important skills and contents such as theoretical knowledge, preparation before operation, reading vernier caliper, principles of safe operation, planning processing technical process are also tested. These tests can cover almost all key points and truly reflect students' performance, and students are motivated to do every step as well as possible [9].

## 4. Summary

Because the contents of lathe work practice are very classical and hard to perfect, this paper mainly discusses how to improve the teaching quality of lathe work by perfecting teachers' teaching and students' studying. Based on the present condition analysis of lathe work practice teaching, some suggestions on teaching reform are presented in this paper. Various teaching methods and forms are helpful to catch students' attention and arouse study enthusiasm. Flexible management can give students security assurance and enough freedom. Comprehensive evaluation criteria can completely and truly reflect students' performance. The implement of the suggestions shows that the teaching quality and students' comprehensive abilities have been improved obviously.

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