

Experiment and Practice Teaching Reform of Mechanical Principle

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Abstract. Mechanical principle is a major professional foundation course of mechanical specialty, which has both theoretical and practical contents. As important components of mechanical principle teaching, the experiment and practice teaching supply students with opportunities of expanding study outside the classroom teaching. Different from classroom teaching, experiment and practice teaching mode is students practice with teachers' directions. Students have more freedom but the process is harder to control. For improving the teaching quality of experiment and practice, this paper analyzes the existed main problems and presents the corresponding solutions. The solutions cover changing traditional ideas, strengthen laboratory management, build teaching system and score evaluating method.

1. Introduction

As a basic introductory course of mechanical specialty, mechanical principle introduces the theory and methods of analyzing and designing four-bar mechanism, cam mechanism, gear mechanism and other motion mechanism. Students are expected to not only master the knowledge but also have enhancement on fundamental skill, practical ability and innovative ability. The experiment and practice teaching mainly trains students' comprehensive ability. Different from listening to the teacher passively in most of class time, students need to do more active thinking and practice in the process of experiment and practice. Students have opportunities of independent work. By studying the experiment and practice, students can build connection between theoretical knowledge and practice, apply basic knowledge of mechanism to practice and improve innovative ability further [1-3].

2. Existing problems in experiment and practice teaching

In many universities, experiment and practice of mechanical principle is not seen as important as classroom teaching. The situation is mainly caused by the following factors:

(1) Experiment and practice are usually seen as the supplementary content of classroom teaching. The traditional viewpoint lasts a long time and is gradually accepted by many teachers and students, which causes teachers and students not to pay enough attention to experiment and practice.

(2) Teachers often adopt traditional methods and modes to carry out experiment and practice. Some methods and modes are not interesting and fascinating for students [4]. Students can hardly focus all attention on experiment and practice, and the study quality is far from satisfying. There are not enough support encouraging teachers researching and carrying out advanced teaching ideas. Effective measure and advanced methods such as heuristic teaching and inquiry teaching are lack for cultivating students' creative thinking and ability.

(3) There are not plenty of budgets to replenish new experimental facilities and upgrade old ones. A facility is often used by five or more students. Complete supporting facilities are also necessary to be equipped. Besides that, management system is urgent to make and perfect in order to make sure the facilities and resource of laboratories used safely, reasonably and fully.

(4) The numbers of experiment is not large and the contents lack change and update [5]. A high proportion of experiments are demonstrative and demonstrating [6]. Students are required to finish experiments according to the requirement of experimental instructions within the certain time. The whole process is under the teachers' instruction and follows prescriptive methods, which gives students little chance to think and can hardly stimulate students' interest in study. And experiments are quite different from actual production. Students often feel out of fashion and unattractive.

(5) The student score evaluating method is not reasonable [7]. The score is mainly decided by result, report or paper, which can hardly reflect students' real grades. Reasonable score evaluating method should be built to stimulate students' learning energy.

3. Methods of solving existing problems

By studying mechanical principle, students should grasp basic knowledge of mechanism and have the ability of designing and analyzing main mechanism. They are expected to develop practical and innovative ability further. Experiment and practice teaching can give students the chance of approaching actual production. In this section, four methods are presented to mitigate and solve the above problems. The details are as following.

3.1 Attach enough importance to experiment and practice

As the development direction of mechanical engineering, engineering education professional certification puts experiment and practice on one of the most important positions, which is centered on students and build outcomes-based education system [8]. More and more universities repair and perfect the syllabus to meet the requirement of passing engineering education professional certification. Both teachers and students need to change past viewpoint on experiment and practice. Universities need to gradually build the teaching system that place students on principal status, and optimize position on the goal "cultivating the high quality practical talents with initiative, innovation, and practical capacities". Corresponding concrete methods and measures should be taught to teachers and known by students. Teachers and students should reach an agreement on this issue that experiment and practice is crucial to enhance comprehensive ability.

3.2 Strengthen construction and management of laboratories

With the rapid renewal of education conception, experiment and practice are received more and more emphasis and the budgets increase gradually. How to use the budgets reasonably is particularly important. In the past, most of budgets are spent on equipment and little is spent on training experiment teachers. However, for teaching quality improvement, the development of teachers is more important than equipment. Experiment teachers should be given more support to have further study and communication. Only by upgrading the capabilities of experiment teachers, students can be obtained more and better instruction from them and experiment and practice will be able to improve.

3.3 Build reasonable experiment and practice teaching system

In order to meet growing requirement of fundamental skill, practical ability and innovative ability, many contents in existing syllabuses of experiment and practice need to revise. In experiment syllabus, basic experiment should be implemented firstly, and the following is comprehensive and designing experiment. The research experiment is scheduled in the end. Students can gradually go deep into the experiment and have more freedom of practice. In curriculum design syllabus, the process management should be paid special attention to. Daily management system should be built to supervise students' performance to ensure the study quality. In extracurricular science and technology innovation syllabus, the coordination between teachers and students is the most important. As a basic system of postgraduate cultivation, the tutorial system is suitable for directing students to participate in extracurricular scientific research. And many methods used in postgraduate cultivation can also be modified and considered to apply to undergraduates. Besides that, modern and diversified teaching ways should be adopted. For example, movement locus of gear engaging point is an invisible and abstract straight line. Selected videos and physical models can be used for showing the

result [9]. The contents of experiment and practice need to update and the outdated contents should be removed or optimized to meet current teaching needs. In teaching mode, the problem based learning (PBL) method is a teaching mode based on the learning theory of building structure, which is suitable and preferred for experiment and practice.

3.4 Build reasonable student score evaluating method

Traditional score evaluating method mainly focuses the result of experiments and practice but ignores the process, which can hardly reflect students' performance faithfully and comprehensively. Students are easily guided to put emphasis on good result instead of studying and thinking in the process. Therefore, a fair and efficient score evaluating method is crucial for giving students fair grades, which can stimulate students' learning interest and improve teaching quality further. The final score should be decided by both usual achievement and operation test. The usual achievement includes experiment preparation, operation, record, result, report, attitude and innovation. These parts are set proper percentages. Before operation test, students are taught detailed operation procedures and told the grading rules. For higher scores, students need to try best to implement every class seriously. The improved score evaluating method can make students go all out to do their best in every step and their comprehensive ability enhanced obviously.

4. Summary

Because mechanical principle is both theoretical and practical, experiment and practice are important to train students' practical ability. However, there are a few problems in present experiment and practice, which cannot meet growing requirement of ability cultivation. In order to improve the teaching quality of experiment and practice, this paper points out the main problems and presents solutions. The solutions have been applied in mechanism design, manufacturing and automatization in Suzhou University of Science and Technology. Teachers and students feel obvious difference from the past. Students have more energy and passion in experiment and practice study, and comprehensive ability are improved more. All problems may not be solved by the presented methods. Continuous improvements are still very necessary to implement in the future teaching.

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