Based on the Open Teaching of Material Mechanics Experiment Teaching Reform

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Abstract. Through the material mechanics experiment and comprehensive project for the construction of the open experiment, the material mechanics experiment in project Settings can guarantee to complete the basic content of the syllabus requirements, linked to the development of modern engineering technology and the expansion of the content; At the same time of improving teaching methods and practice teaching conditions, and combined with teachers' scientific research project, the innovation of the multiple comprehensive experiments with engineering background, improve the students' practical ability, enhance their study enthusiasm.

Introduction

Mechanics of materials is one of the important professional basic course for the engineering specialty, and experiment is the important component. Material mechanics experiment teaching can make students learn the basic knowledge of mechanics experiment, the basic skills and basic methods, the students consolidate the fundamental theory, strengthening basic operating skills, training thinking ability is very important; Especially comprehensive, research-oriented experiments in cultivating students’ practice ability and innovation ability, improve the comprehensive quality of students has an irreplaceable role. Traditional practice teaching mode, as a result of the limitation of experimental classes and the experimental conditions, the focus on the verification experiment, less comprehensive, designing experiments, experiment content and steps of rules more strictly, limiting the student's creative thinking[1]. Open experiment teaching mode is proposed, which can provide students innovation ability and engineering ability plenty of time and space, is to deepen teaching reform, from passive to active education, full of the effective methods to improve the quality of experimental teaching.

Set up Open Experimental System

Take a completely open experiment teaching mode is the open experimental field, the experimental equipment and experimental content, in addition to complete teacher to arrange the experiment content, independent experiment by the students. This pattern is recognized as an effective training students thinking ability, practice ability and innovation ability of teaching mode, is a direction of experiment practice teaching reform.

For experiment center between the original experiment course independently, there is no consistency, experiment content without grading standards and training target system, experiment content focus on the present situation of the verification experiment, to establish a unified style of the experiment system. The whole experiment course of initial start from practice, interlocking, pay attention to the unity of the style and content between curriculum and course of cohesion. And on this basis, to realize the center open all courses. Laboratory experiment content can be divided into will do basic experiment, experiment and design experiment, all students must complete the experiment content is basic experiment, reference to the teaching of part teaching contents of the plan, the content is relatively fixed. Laboratory will be open each semester, students experiment time and content, and so on and so forth in center website, in the open time, students through the
way of online booking, in the appointment time to preview or doing the experiment in lab, can be
done repeatedly. The advantage of this kind of open mode is able to according to the theoretical
basis and practice ability of students, on the strength of the greater flexibility in time to the student,
the students basic skills of instrumentation equipment, enhance the practical ability of students and
analysis problem, problem-solving ability. At the same time improving the utilization efficiency of
lab instruments and equipment. Students on the basis of complete will do after the experiment,
according to his ability, special skill, hobbies, and so on and so forth autonomous in selected as
selecting experiment project, experiment and designing experiment groups also encourage students
to complete more complex type comprehensive design experiment, to promote students’
autonomous learning, cooperative learning, inquiry learning of new experiment teaching model, can
produce strong operation ability, innovation ability and the excellent student have certain basic
knowledge of scientific research[2].

Integrated Design and Experiment Research Project, Using Project Experiment

Students free combination to form the Project team, every Project team development Project in
advance from the teachers choose a Project in the Project, according to the requirements of the
Project, the collection of data, combined with the mechanical professional knowledge, solving
practical problems involved in the Project of engineering, experimental research report, the defense.
Is to solve how to cultivate students’ innovative spirit and experimental skills.

Open Experiment Project through Mechanics Basic Experiment to Test for a Common
Thread. And complement, in conjunction with theoretical teaching in content is given priority to
with comprehensive experiment and designing experiment, cultivating the students’ comprehensive
experimental skills and comprehensive applied mechanics experiment technical analysis and
solution actual problem ability, and ability to innovate, through the experiment to make the students
to lay a solid foundation for future learning.

Development of every experimental project contains a number of experiment content, cover and a
number of theoretical knowledge of composite mechanics curriculum. In order to meet the need of
different levels students of teaching, the difficulty of the content of each project has different, even
some experiments Content was no ready-made theoretical solution, need flexibility to the integrated
use of basic theoretical knowledge, students through the process of "experiment repeatedly
experiment” theory, the mechanics model is set up, studies its theoretical solution, with the result of
the experiment to test the mechanics model.

Comprehensive Experiments Mainly Is to Cultivate Students' Comprehensive and Designed
Experiments and the Ability to Study and Research in the Experiment. Such experiments, can
be material in different course teaching content of comprehensive, can also is a combination of
different disciplines. Is usually the teacher according to the nature of the problem put forward the
experiment request, let the students design experimental project specific steps.

Static strain stress comprehensive test experiment is one of them. When we design the
experiment to infiltrate into basic experiment, electrical measuring method to strengthen the
electrical measuring experiment of weight, is a level of material mechanics experiment, but does not
change the nature of the course. Due to the scheme of equipment miniaturization laboratory
homemade 18 sets of small beam intensity, resistance strain gauge students doing paste can ensure a
person a when technology experiment, through the experiment the students use electrical
measuring method and the electric resistance strain gauge, the teacher asked the students on the
material mechanics experiment platform of h beam, beam (composite beam) stack, such as strength
of beam with electrical measuring method of measuring the stress of stress, the strength check.
Students are required to do first theoretical analysis, the experiment scheme, his stick strain gauge,
welding wire, strain gauge connection and debugging, data record, error analysis, write test report
or essay. Through such comprehensive training, there is obvious improvement in students' practical
ability, learning motivation is enhanced.

Project Integrated Test. This experiment projects is the key of the open experiment project,
experiment content is based on the experiment center of scientific research project for the prototype.
Projects have residual stress testing experiment, high strength bolt connection coefficient of friction surface slip resistance measurement, cut and lifting platform structural static and dynamic stress test, etc. The project was rated as excellent comprehensive experimental project in our school.

With shear fork lift platform structure static and dynamic stress test case. The project for the seniors, shear fork lifts as test object. Test requirements to teachers, students themselves making experiment plan, the teachers, after checking your completed test. This experiment involves the structural stress analysis, resistance strain gauge paste, static stress test, dynamic stress test of four aspects, includes the basic theories of structural static and dynamic stress measurement knowledge and method of application, constitute a complete electrical measuring teaching system. Student experiment, in the form of team need to work closely to complete the task. Through the experiment, students really understand the process of engineering practice, stress test, have the feeling of the field test, to cultivate the practical ability, team work spirit and mechanical structure analysis. The whole experiment achieved from a single theoretical study to solve practical problems. At the same time the experiment on the outstanding senior students, increased by ANSYS software to establish model, the method of using finite element numerical simulation for stress analysis of the structure of shear fork[3].

Open Experiment Teaching Results

Open Experiment Teaching Effect Is Remarkable

Open independent experiment mode is popular among the students, make full use of laboratory equipment and resources, students can enter the lab at any time, according to their time and knowledge in specific experiments. At the same time, various forms, rich in content of open experiment content has attracted a lot of students to the laboratory experiment, interesting experiment independently, obviously improve the student's learning effect, to further strengthen engineering practice ability. Teaching effect shows that the open experiment teaching, improving the students' autonomous learning, cooperative learning, inquiry learning enthusiasm and ability, laboratory open in an all-round way, provides professional experiment teaching ideas and creating new teaching mode, to further enhance students' practical ability and comprehensive quality.

Promote the Student Extracurricular Technological Innovation Activities

Open experiment platform for the students to build a good innovation practice environment, can carry out a variety of extracurricular science and technology (competition) activity; Organizational innovation experiment design competition. In order to further innovation of material mechanics experiment teaching, the laboratory under the condition of existing experimental equipment, held a contest of college students' mechanical innovation design of experiment. Innovation experiment design competition for college students provides a self organization, design, production, testing, analysis, reasoning, comprehensive engineering practice opportunities.

Mechanical innovation experiment competition not only stimulated the students' innovation consciousness, and cultivate the students in frustration and failure under the impact of teamwork spirit. Through our efforts to create conditions for students to build a platform of engineering practice, through this platform to make the students in the integrated design of engineering structure, production process, experimental analysis, experiments, comprehensive ability to analyze and solve problems on fully exercise. The practice proved: the extracurricular activities of science and technology development, expand the connotation of the experimental teaching, the students' engineering practice and get more.

The student curriculum design: Based on the finite element structure analysis and optimization design of lathe spindle. Figure 1 is a static structural analysis of the Equivalent stress diagram; Figure 2 is Modal analysis results of the second order modal shapes.
Further Promote the Teaching Reform

Through the opening experimental platform construction, form a batch type and combined closely with the production practice of the design, synthesis, experiment research, forming a batch of hardware and software, suitable for the combination of the school level students' graduation design subject and curriculum design topics. For example: the five kinds of drive shaft of static strength, deformation and fatigue strength calculation; Rear HZ140TR2 tour bus chassis frame research; Single cylinder diesel engine crankshaft strength design and strength calculation, fatigue.
intensity, etc.; At the same time make full use of the platform, and promote the construction of the platform.

Summary

Open experiment teaching of exploration and practice, the application of research achievements in teaching experiment, the practical problems in engineering can be incorporated into teaching, can avoid the disadvantages of simple books teaching, thus greatly broaden students' horizons greatly stimulate the enthusiasm of students' learning; To improve the initiative of students' autonomous learning, cultivate the students' innovation ability and engineering ability. Although good results were obtained in the platform construction, but there will be a lot of work to do, such as an open experiment quality control system, etc. Need to accumulate in the platform construction, continuous efforts, to provide students with a scientific and perfect experiment platform.

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