

Application of Computer Simulation Technology in the Experiment Teaching of Automobile Theory

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Abstract: Automobile theory is an important core course for automobile majors which has the characteristics of both theory and practice. Practice teaching is an important teaching link. However, some schools are limited by the hardware conditions so that there are some problems, such as inadequate experimental items and few experimental opportunities for students. The advantages of computer simulation technology in practical teaching aiming at this situation are analyzed, and the application of Matlab simulation software in automobile theory experiment teaching is discussed. The combination of real vehicle experiment and software simulation can effectively solve the problem of insufficient experimental conditions and improve students' interest and enthusiasm for learning, thus effectively improving the teaching effect.

1. Introduction

Automobile Theory is one of the important professional courses for automobile majors, such as vehicle engineering and automobile service engineering. It is also a compulsory or elective course for other related majors. It has the characteristics of wide range of knowledge, wide benefit area for students, close combination with theory and practice, strong practicality and innovation [1]. The course is one of the important teaching links to cultivate students' professional quality, practical ability and innovation consciousness.

The course emphasizes both theory and practice. The theoretical teaching part has many formulas, the content is abstract and difficult to understand. The students sometimes lack learning interest, while the experimental teaching is the verification for theoretical teaching [2].

Through experimental teaching of Automobile Theory, The students are required to understand the working principle of automobile test instruments, master the operating procedures of the instruments, and cultivate the ability of operation, and also perform performance analysis based on the data obtained from the experiments [3-4]. Due to the limitations of experimental sites, equipment and experimental personnel, only a small number of experiments can be carried out. A considerable part of the experiments cannot be carried out, and some dangerous working conditions experiments cannot be completed, which limits the development of practical activities and the improvement of students' practical ability.

With the development of computer technology and communication technology, virtual simulation has played an increasingly important role in curriculum teaching, especially in practical teaching. The simulation software is introduced into the teaching practice of automobile theory, and the theoretical analysis and simulation experiments are combined to strengthen the teaching practice, so as to stimulate students' interest in learning, and better grasp the teaching content and improve the teaching effect in limited hours.

2. Experiment Teaching of Automobile Theory based on Computer Simulation

2.1 Problems in Experimental Teaching of Automobile Theory

Automobile theory is a course that is closely integrated with theory and practice. Students learn about the theoretical knowledge of the automobile in classroom teaching, and deepen and

consolidate the understanding of theoretical knowledge through the perceptual knowledge gained in the course of practice.

The experiment teaching is a process of combining theoretical knowledge and experimental activities, indirect experience and direct experience, abstract thinking and image thinking, and imparting knowledge and training. It can cultivate students' keen intuition ability, creative thinking method, tenacious perseverance and the spirit of exploring unknown and courage in innovative.

Under the background of the credit system of Linyi University, the Automobile Theory course has fewer study hours, and the practice links and class hours are also insufficient. The experiments are mainly confirmatory and comprehensive experiments. In the course of the experiment, the degree of student participation is not high, and the current experimental teaching mode lacks the guidance for the enthusiasm and initiative of the students.

2.2 The Function OF Computer Simulation Technology in The Teaching of Automobile Theory

The simulation experiment through simulation platform is an effective method to make up for the lack of real vehicle experiment, and it is also an important method to improve the teaching effect of automobile theory [5]. It is a major trend in the research of automobile theory experiment teaching reform.

Adding computer simulation technology to the teaching of automobile theory can integrate the teaching resource with traditional resources, let some abstract things become more concrete. The role of computer simulation technology in automotive theory teaching is as follows.

2.2.1 Stimulate Students' Interest in Learning and Improve Their Enthusiasm

By the traditional teaching method, teachers tend to abstract the automobile, and it is difficult for students to have a specific model in their minds. Using computer simulation technology can make automobile theory knowledge easier to understand.

2.2.2 Cultivate Students' Learning Autonomy

The computer simulation technology can promote students to apply theory to practice, which can improve their ability to solve practical problems, improve the efficiency of students' listening, improve the quality of teachers' teaching, and make the classroom lively and interesting.

2.2.3 Computer Simulation Technology is Flexible, Intuitive and Safe

The computer simulation technology is applied to the practice of automobile theory, allowing students to simulate the experimental content through simulation software, so that there is no risk generated by on-site training, and the efficiency of training can be improved, and the error of training results can be reduced.

2.3 Computer Simulation Technology

There are many simulation tools commonly used in vehicle dynamics simulation, such as: CarSim, Adams, Cruise, and Matlab, which have their own advantages and disadvantages.

MATLAB software is now one of the most authoritative and practical computer software in the field of simulation. MATLAB is a visual computing software, which is powerful and easy to use. It is widely used in scientific and engineering computing, including automobile design and analysis. The research institutes or technical centers of major automobile companies and component companies have applied MATLAB in a large number of research and analysis work.

By using MATLAB as a tool in the teaching of Automobile Theory, the teachers and students can easily calculate various performances with its powerful calculation function and graphics function. At the same time, using MATLAB numerical calculation function and Simulink software, the complex process can be simulated and solved [6]. The results of these calculations and analyses can be presented to students through the visual means provided by MATLAB, which helps to clearly articulate abstract concepts and systematically simulate complex analytical processes.

2.3.1 Easy to Learn and Use

Matlab is not only an intuitive and efficient computer language, but also a scientific computing platform. It is simple in syntax, friendly in interface and easy to use.

2.3.2 Convenient and Practical Graphics Function

There are many curve graphs that need to be drawn in the course of Automobile Theory. The drawing function of traditional programming language is extremely inconvenient to use. The programmer needs to understand the complicated software knowledge such as the computer graphics mode, and has to do a lot of settings and conversion work before drawing.

MATLAB provides powerful drawing functions for engineering common graphs, both 2D and 3D graphics can be easily handled. It can fully meet all the needs of scientific and engineering calculations. The syntax of these function is simple and easy to master.

2.3.3 A Large Number of Numerical Functions

In the course of Automotive Theory, a lot of numerical calculations are involved, and it is not advisable to use a general programming language to write these difficult numerical subprograms. MATLAB has powerful numerical calculation capabilities and provide a large number of optimized numerical functions that users can call directly in MATLAB and other languages without having to care about their implementation methods and details.

2.3.4 Rich Toolboxes

MATLAB offers a large number of feature-rich toolboxes that fall into two categories: functional toolboxes and discipline toolboxes. The functional toolbox is mainly used to expand its functionality and can be used in a variety of disciplines. The discipline toolbox is professional.

3. Application Examples of Virtual Simulation of Automobile Theory Experiment

3.1 Status of Automobile Theory Experiment Teaching

At present, the experiment of Automobile Theory has 6 hours, mainly completing 3 experiments, including automobile dynamics test, automobile braking test, automobile side slide test, and so on. The experiment items are given as shown in Table 1.

Table 1 The experiment items of Automobile Theory

| No. | Experimental Name | Main Experiment Content | Experiment Hours | Experiment Type | Experiment Property |
|-----|----------------------------|---|------------------|-----------------|---------------------|
| 1 | Automobile dynamics test | Master the evaluation indicator and test method of Automobile dynamics performance. Learn the method of operating chassis dynamometer. | 2 | Comprehensive | Essential |
| 2 | Automobile braking test | Master the structure and working principle of the automobile braking test bench. Understand the detection steps of the automobile braking performance | 2 | Comprehensive | Essential |
| 3 | Automobile side slide test | Master the structure and working principle of the automobile side slide test bench. Understand the detection steps of the automobile side slide performance. | 2 | Comprehensive | Selective |

3.2 Experiment Teaching Reform of Automobile Theory

In the simulation software, Matlab is easy to use and understand, moderate in difficulty, and fast in simulation. The simulation experiment is not affected by factors such as time, site and experimental equipment. The experimental content is comprehensive, repeatable and efficient.

The automobile Theory course covers the main performance, evaluation indicators and test methods of automobiles, such as dynamics, economy, emissions, braking, handling stability, ride

comfort, and possibility.

This course combines the real vehicle experiment with the simulation experiment. The students complete the real vehicle experiment in the class. Under the guidance of the teacher, the students complete the required mandatory project and completes other projects independently by the virtual simulation software. Therefore, by adding the simulation experiment to make up for the insufficient of actual vehicle experiment.

Throughout the teaching process, the teacher teaches students to master the use method of software. The teacher designs the experimental questions according to the teaching needs, and gives the basic parameters of a certain car model, and requires the students to analyze and evaluate the various performances of the vehicle according to the theoretical knowledge of the vehicle.

4. Conclusion

Introducing computational simulation technology into the teaching of automobile theory course is a teaching mode discussion. In particular, MATLAB is a highly versatile software. It can be used in combination with real vehicle experiments to complete automobile theory experiments and overcome the limitation of experimental personnel and ground equipment. The combination of real vehicle experiment and virtual simulation experiment can deepen students' understanding of the dynamics, economy, handling stability and ride comfort of the Automobile Theory Course, improve students' enthusiasm for learning, independent learning ability, and thinking ability and practical ability.

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