

Original Research Article

# Teaching Reform of "Thermal Fluids" Course Combining Theory and Practice

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**Abstract:** Thermal fluid is an interdisciplinary subject involving heat transfer, hydrodynamics and thermodynamics. It is an important professional basic course in the field of automobile. Thermal fluid theory is widely used in automobile design and research, this thesis discusses the research method of combining theory and practice from the basic theory of "Thermal Fluids" course and the principle of heat transfer and cooling of electric vehicle power battery in conjunction with the needs of electric vehicle research. This thesis is based on the theoretical content of Thermal Fluids course, with the establishment of practical cases as the core, the reform of teaching means, teaching methods and teaching modes as the breakthrough, and the improvement and guarantee of teaching quality as the purpose, guiding students to apply thermal fluid theory to analyze and solve practical engineering problems, which has achieved good results.

**Keywords:** Theory, practice, thermal fluids, teaching.

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## 1. INTRODUCTION

With the advancement of science and technology and the development of new technologies, more attention is paid to cultivating practical talents with professional knowledge and innovative ability in the field of new energy. EV vehicles involve multiple interdisciplinary disciplines, and there are barriers in the curriculum system and course structure between related disciplines and majors. The course "Thermal Fluids" contains the basic theory of fluid mechanics, thermodynamics and heat transfer, and is an important basic course for science and engineering majors, which is an important bridge to connect multiple majors. Therefore, the theory of "Thermal Fluid" is an important foundation for the study of new energy vehicles, and it is an important "theory and practice all-in-one" course for new energy vehicle majors. This thesis analyzes the current problems of the course "Thermal Fluids" and establishes a library of practical application cases, which is of great significance to cultivate professionals with comprehensive development of theory, experiment, application and innovation.

## 2. EXPERIMENTAL SECTION/MATERIAL AND METHODS

### 2.1. Problems of theoretical teaching

The development of new materials, technologies, and electronics has led to significant

changes in the structure of automobiles [2-4], thus placing higher demands on the teaching of the course "Thermal Fluids". Under the existing teaching methods and teaching modes, students still cannot accurately apply thermal fluid theory to automotive design after learning the "Thermal Fluid" course, and there is a general shortcoming of separation between theory and practice. In order to cultivate applied talents that meet the needs of society and improve the overall quality of students, it is of great theoretical significance and application value to carry out teaching reform with the core of improving students' theoretical level of problem analysis and practical ability of problem solving.

### 2.2. Problems of practical teaching

**Current practice teaching has the following problems**

1. Influenced by the traditional education concept of emphasizing theory and neglecting practice, students generally pay insufficient attention to practical teaching, which affects the quality of teaching and talent training [5-6].
2. The diversity of thermal fluid courses and the complexity of their content make them difficult for students to understand.
3. In the form of teaching, theoretical courses involve many teachers, and the number of credit hours taught by each teacher is small, which results in incomplete and non-objective monitoring of

teaching quality [47-9].

4. Lack of information collection, management and feedback mechanism in practical teaching, and its quality cannot be effectively guaranteed.

### 2.3. Teaching method combining theory with practice

In the course of "Thermal Fluids", it is difficult to implement the teaching method of combining theory and practice in teaching, and there is a problem of biased teaching of theoretical knowledge and lack of practical teaching activities. This project takes the reform of teaching content as the core, the reform of teaching means, teaching methods and examination methods as the breakthrough, and the improvement and guarantee of teaching quality as the purpose. Cultivate students' learning ability, practical ability and the ability to analyze and solve practical engineering problems. It also puts forward the teaching methods and specific measures to strengthen the cultivation of students' ability [7-9]

This subject adopts a "theory-practice" teaching method. Theoretical teaching and practical application go hand in hand and complement each other. In terms of theoretical instruction, it is divided into theoretical viewpoint, exercise tests, and group discussions. The teaching method is mainly to tell the theoretical knowledge in class, so that students can master the theoretical knowledge of thermal fluid course. Examine the students' mastery of theoretical knowledge by exercises. Identify weaknesses in knowledge through group discussion. In terms of practical teaching, it is divided into case discussions and simulation experiments. A case library of electric vehicle research is established and divided into modules such as power battery, cold plate, body and chassis, and simulation experiments are conducted at different levels.

According to the characteristics of the thermal fluid course, when introducing the thermal fluid theory, we adopt the visual teaching method to show the students the simulation case of electric vehicle with the application of thermal fluid theory, so as to strengthen the students' perceptual understanding and make the teaching achieve twice the effect with half the effort. When explaining important theories, we analyze cases while explaining them. For example, the geometric heat dissipation model of power lithium battery is established according to the basic theory of heat transfer, and the coupled theory of electrochemistry and heat transfer is used to simulate the electric vehicle power battery, analysis of the temperature field distribution from the thermal model of a single cell to a battery pack discharging the cell under different environmental conditions. Make targeted adjustments and keep an eye on new automotive technologies, while increasing student motivation and creativity. Students enhance their practical hands-on skills through simulation experiments. Integration of experimental

theory and practice in professional courses. Cultivate complex higher technical application specialists who can apply modern science and technology, have strong practical hands-on ability and innovative spirit, and master modern theory and practice [10-12].

## 3. RESULTS AND DISCUSSION

In the combination of theory and practice, with the core of improving the quality of theory teaching, we have gradually established a set of quality control system combining theory and practice, which has played an active role in promoting the application of theory and strengthening the cultivation of students' practical ability and innovation ability. Its effectiveness is mainly manifested in the following aspects:

- 1) The theoretical knowledge of "Thermal Fluids" is applied to the study of thermal management of electric vehicle power batteries. In the course of "Thermal Fluids", the basic performance parameters of power lithium-ion battery such as voltage and capacity density and the basic composition of lithium battery and the principle of electrochemical reaction are studied, and the mechanism of battery heat production and heat transfer is also studied. This course integrates the automotive theory course and scientific research into one, promoting each other, complementing each other.
- 2) The combination of the theory of "Thermal Fluids" and the case study of electric vehicles makes the teaching quality of "Thermal Fluids" strongly guaranteed, solves the problem of "Duck-stuffing" type of teaching and students' lack of innovative consciousness, and improves students' enthusiasm and innovative spirit of learning. At the same time, the combination of theory and practice provides an important theoretical basis for the research of departmental energy vehicles.
- 3) Applying the theory of "Thermal Fluids" to the research of electric vehicles, the electric vehicles developed by some school students have achieved good results in the national new energy vehicle competition. The above achievements fully prove the good effect of applying the theory of "Thermal Fluids" to practice.

## 4. CONCLUSION

In order to improve the teaching quality of "Thermal Fluids" course, this paper explores the teaching method of combining theory and practice, and establishes a practical case library to train students. It is of great significance to improve the quality and ability of students.

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