

## Research Article

## The Practice and Exploration of Improving the Academic Ability of Postgraduates in Course Teaching--Taking "Advanced Thermodynamics and Principles of Internal Combustion Engine" As an Example

Ren Hongjuan<sup>1\*</sup>, Liu Huarui<sup>2</sup> and Xu Huawei<sup>2</sup><sup>1</sup>Shanghai University of Engineering Science, Shanghai, 201620, China<sup>2</sup>Shanghai City Science and Technology School, Shanghai, 201620, China\*Corresponding Author  
Ren Hongjuan

**Abstract:** In the process of postgraduate training, how to improve the academic ability of postgraduates is an important topic that every tutor and teacher must consider. This thesis use the course teaching of higher principle of thermodynamics and internal combustion engine as an example, during the teaching process, graduate student academic ability, information retrieval ability, scientific research and innovation ability, the thesis writing ability and the ability of academic exchange are cultivated. Based on the basis of theoretical knowledge and ensuring the students master course, improve the student's academic ability, provides the necessary preparation for the future research and employment.

**Keywords:** thermodynamics and internal combustion engine.

### INTRODUCTION

Postgraduate education is the highest level of academic education, the main way to cultivate high-level innovative talents, and an important pillar of national competitiveness and innovation. It plays an important role in promoting national economic development and the improvement of comprehensive national strength (Baowen, W. *et al.*, 2016) In general institutions of higher learning, theoretical courses are mainly taught in the first year, and graduate studies are carried out in the second and third years. In addition to teaching the basic knowledge of the course, theoretical courses should also focus on cultivating students' scientific research ability -- literature retrieval ability, innovation ability, paper writing ability and language communication ability, so as to lay a good theoretical foundation for future research. Therefore, in the course of theoretical course teaching, teachers should design teaching methods reasonably and arrange teaching modes flexibly according to the course content, so as to improve the theoretical level and exercise various abilities effectively.

"Advanced thermodynamics and principles of internal combustion engine" is an elective course for graduate students majoring in vehicle engineering, which mainly involves advanced thermodynamics, emission pollution and control of automobile engine, combustion and model construction of automobile engine, performance optimization of automobile engine, etc. It requires students to learn the latest professional knowledge with the help of network and books while learning the traditional theoretical knowledge. Therefore, in the process of teaching, the author constantly improves the teaching mode, deepens the reform of classroom teaching, and makes some achievements in the cultivation of graduate students' ability.

### 1. Classroom Teaching Content Organization and Model Reform

#### 1.1 Cultivation of Literature Retrieval Ability

Literature retrieval refers to the process of obtaining literature according to the needs of study and work. Modern literature refers to articles and books of historical value or important books and materials related to a certain discipline (Yan, H. 2009). With the development of modern network technology, literature

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retrieval is more completed by computer technology. Explosive information growth shows in front of students. How to find the useful information they need in the infinite amount of information is an important problem for students (Yunzhi, C. *et al.*, 2019). However, the research content, research method and researchers' literature retrieval ability are increasingly closely related. In order to expand research ideas and aim at the research frontier, students must have certain literature retrieval ability.

Students' information retrieval ability is the basis of their later scientific research activities. In order to cultivate students' information retrieval ability in the process of classroom teaching, it is suggested to add engine frontier knowledge retrieval to classroom teaching. Through voluntary grouping students, choose a direction of the development of the automobile engine, such as hybrid car engine, engine emission reduction technology, engine, engine fuel technology, students are required to through domestic literature database search "China journal full-text database", "Chinese science and technology periodical database", "Journal of the data resource system of Wanfang" and foreign commonly used literature database, study the research progress of the forward direction and key technology, so as to enable students to master how to quickly find the required documents, and important information to study, and then making PPT, for classroom discussion. In order to stimulate the initiative of students, the group discussion is included in the usual score. Practice has proved that this teaching mode has laid a necessary foundation for the cultivation of postgraduate thesis writing and research topic selection.

### **1.2 Cultivation of Scientific Research and Innovation Ability**

Graduate students are different from undergraduates. Graduate students must have the ability of innovation, that is, the ability of finding, analyzing and solving problems. The innovation ability of postgraduates is mainly reflected in their scientific research innovation ability. In order to achieve the training goal of postgraduate education, the cultivation of scientific research innovation ability is of vital importance (Yanping, T., & Wei, D. 2015).

Our graduate students come from different institutions of higher learning in China. Although the undergraduate courses are basically the same, the teaching and experimental conditions are different. Graduate student stage, in addition to the routine teaching, also focus on teaching should be taken with a combination of graduate student self-study, lets the student understand the car engine frontier technology as soon as possible, and have mastered theoretical knowledge learning about cutting-edge technology realization method of arrangement graduate as soon as possible into the automobile engine laboratory, students are encouraged to contact the car engine specific open

test and lab experiment, related operations involved in the experiment, improve the level of theory with practice. In the process of classroom teaching, the experiment safety, operation standard, experiment log writing and other issues were emphasized in combination with the experiment, and open questions were put forward for the experiment to guide students to think. Discharge pollutants such as interpretation of automobile engine, encourage students to participate in the engine emission test, to grasp the method of automobile engine bench test and detection method of different discharge of pollutants, encouraging the students to look for the discharge of pollutants influence factors, the design of engine emission experiment, thus to further strengthen the student's understanding of discharge pollutants generation mechanism and control, to promote students' thinking to control the pollutants, which will effectively improve the students' scientific research innovation ability.

### **1.3 Paper Writing Ability Training**

Writing a dissertation is a necessary condition for obtaining a graduate degree. Upon completion of their studies and publication of a certain number and quality of theses, graduate students can only obtain the corresponding degree after passing the dissertation defense. Our school requires that at least 2 Chinese core papers and 1 dissertation should be published during the postgraduate study period. Therefore, the teaching process should focus on training students' language expression and writing academic papers.

In actual teaching, when the content of the course involves graphs, students are guided to express pictures and logic, which will improve their ability to write papers in the future. For example, when explaining the law of influence of engine inlet pipe diameter on charge coefficient, guide students to analyze the curve variation trend from the aspects of influence of constant pipe length pipe diameter and influence of engine operating parameters, and analyze the reasons based on theoretical knowledge. At the same time, the teaching process, add students to write a research paper link. According to the content of the course, students are required to learn literature review and paper writing in the process of consulting materials. Students are required to find problems, analyze problems and solve problems according to the writing method of academic paper, and repeatedly determine the content involved in the writing, so that students' writing ability can be improved, and take the paper score as part of the course score.

### **1.4 Cultivation of Academic Communication Ability**

Academic exchange activities are research activities conducted to exchange knowledge, experience and results, and jointly analyze and discuss solutions to problems. Academic exchange refers to information exchange. The final result is that scientific information; ideas and viewpoints can be communicated and

exchanged. Academic exchange can promote the all-round development of graduate students and improve the quality of postgraduate training (Xinchun, W. *et al.*, 2018). By participating in academic exchanges, graduate students can broaden their professional knowledge, cultivate their ability to analyze and solve problems, and develop their innovative and social skills. Therefore, graduate students must be encouraged to participate in academic exchanges. In order to better play the role of academic exchange activities, it is hoped that graduate students can actively express their views and questions when participating in academic exchange, which puts forward high requirements on the language expression ability and strain ability of graduate students.

In order to effectively improve the academic communication ability of postgraduates, the class communication link is arranged in the teaching process. Students are required to make voluntary groups, choose a professional question, explain and communicate in class, and add a question-asking link. This has not only exercised the speaker's language communication ability and strain ability, but also trained other students' questioning and communication ability. In the students explain not clear or incomplete, the teacher appropriate supplement. Practice has proved that this will promote students' academic exchange, project report and graduation defense.

## 2. Reform of Examination Methods

The present era is an era of knowledge explosion. Technology changes with each passing day and changes very fast. Therefore, the cultivation of graduate students is no longer just the pursuit of students to remember how much knowledge, but the use of classroom teaching to train students with self-learning, self-improvement ability. The talent of the future is no longer a person who has much knowledge, but a person who can learn and use the knowledge flexibly. In response to this change, the examination method of the course was reformed.

In the examination process, students are required to remember most of the knowledge except the basic knowledge, as long as they can refer to relevant materials to obtain. Therefore, the final exam is an open-book exam, allowing students to bring notes, books and electronic products into the classroom, but not allowed to communicate with each other or think independently. In addition to test scores, the final score also includes classroom communication scores and essay writing scores, with the proportions of 50%, 20%

and 30% respectively. Practice proves that the new examination method, will effectively students from previous cramming for the exam mode to the kung fu in the weekdays, focus on the pattern of various ability, realize the diversity of the appraisal main body, ensure the objectivity and rationality of evaluation, is to achieve the ideal teaching effects, cultivate various abilities of graduate students and ensure the important action of graduation and work in the future.

## 3. CONCLUSION

" Advanced thermodynamics and principles of internal combustion engine " is the vehicle engineering professional graduate student degree elective courses, through the course teaching and examination mode reform, not only make the graduate students to master the advanced basic theoretical knowledge of thermodynamics and internal combustion engine, but also to cultivate the graduate student's academic ability, information retrieval ability, scientific research innovation ability, ability of thesis writing and academic exchanges, it will as a graduate student research and lay a good foundation for employment in the future.

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