Research on Workshop Teaching Method of the Course "Automotive Emission Pollution and Control"

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Abstract: "Automotive Emission Pollution and Control" is an undergraduate professional course for vehicle engineering, energy and power engineering in colleges and universities. In the current teaching model, teaching, questioning, and multimedia are used. Students' mastery of core knowledge is still at the level of instilling, understanding, memorizing or accepting. The mastery of knowledge seems to be solid, but the understanding is not deep, let alone flexible application. Through the course Workshop teaching method, with the core knowledge points of the course as the workshop theme, it promotes the transformation of students from passive learning to active interactive learning, further improves the course teaching effect, and enhances students' research and learning ability. At the same time, it also provides experience reference for curriculum reforms for other professional core courses and professional characteristic courses of engineering.

1. Introduction

The pollutant emissions of automobiles have an increasing impact on humans and the environment, and have gradually aroused widespread concern about pollutant emissions from automobiles. The pros and cons of vehicle emission pollutants control not only affect the natural environment and human health, but also have an important impact on engine performance. At present, automobile emission standards are being further enriched and improved. Engine manufacturers, research institutions, and universities are working hard to reduce automobile pollutants. The majors of vehicle engineering, energy and power engineering in relevant universities have opened "Automotive Emission Pollution and Control". The course lays a solid professional theoretical foundation for the in-depth study of the purification of automobile pollutants and the technical personnel related to the control of automobile pollutant emissions.

At first, "workshop" refers to a way that can provide people with different positions and ethnic groups to think, discuss, and communicate with each other[1]. Later, it is a communication method commonly used in academic conferences,which discussion, questioning and summarizing activity for a certain "technical main". At present, the "Workshop" mode is increasingly used in various fields, and it has become a way to solve specific problems and has attracted the attention of various groups[2]. The teaching mode of the workshop usually adopts the mode of the teacher leading the student team. Under the guidance of the professional teacher, the students discuss and research a certain topic through various methods such as discussion, speech, and practical operation[3]. Colleges and universities such as the University of Maryland and the University of Houston have designed Workshop teaching methods on the specialized issues of some professional courses. Based on the Workshop cooperation project, Hefei University aims to cultivate application-oriented talents, combined with market demand, and uses projects to drive the real teaching of real teaching problems. It realizes transnational, cross-cultural, and cross-industry international cooperation, and has achieved relatively rich results[4].

This research intends to introduce workshop method into the teaching of the "Automotive Emission Pollution and Control" course. Taking core knowledge points in teaching as the theme of Workshop, students can solidly master core knowledge points through practice, classroom environment and other teaching activities. So that students can develop the ability to excavate and

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think about key teaching knowledge points.

2. The Expected Main Content of the Teaching Method Reform Research

"Automotive Emission Pollution and Control" course covers a wide range and scattered knowledge points. In the course of study, students will have the problem of "understanding in class but unable to grasp after class", and even the form of homework inspection after class cannot achieve good results, and it is difficult for students to grasp the knowledge flexibly. Through this research, we hope to further improve the teaching effect of the course and enhance students' research and learning ability. The main contents are as follows:

(1) Theoretical knowledge Workshop teaching method research

The core knowledge points of the course will be selected, and the classroom workshop is used for teaching. So that students can quickly learn materials, refine knowledge points. This teaching method enables students to be profoundly and hierarchically.

(2) Research on Workshop Teaching Method in Practice Link

On-site workshop teaching of important test content and test methods will be carried out based on the basic course practice links that have been basically completed. This can change the traditional indoctrination teaching based on scripts, and expand to scientific research.

(3) Workshop organization model research

Workshop is different from the traditional "discussion-style" teaching. It requires the participation of all students and the guidance of teachers. It needs to adopt a reasonable model design to give full play to the learning initiative of each student.

(4) Analysis of the teaching effect of Workshop teaching method

After carrying out a number of typical Workshop teaching and learning, the improvement of teaching effect by this method will be analyzed through classroom question and answer, final assessment, random interview and after-class interview, etc.

3. The Specific Application of Workshop Teaching Method in the Course of "Automotive Emission Pollution and Control"

3.1 Determination of Teaching Mode

The workshop focuses on student participation and autonomous learning, through mutual communication, discussion and sharing of learning methods to solve practical problems. The whole class consists of 10 students as a group to form several groups. Each group has a student who has a certain amount of knowledge in this teaching session as the core. The members explore a topic in multiple ways through conduct activities, discussions, speeches under their guidance. During this period, the groups communicated and discussed with each other, and finally summarized the knowledge system of this teaching link. Teachers actively participate in the process and are also responsible for the following tasks: discussing the creation of an atmosphere, controlling the process and rhythm, mobilizing students to participate, guiding goals and directions, commenting and summarizing.

3.2 Selection of Core Theory Teaching Links

The theoretical teaching content of this course is as follows: the hazards of automobile pollutants, the generation mechanism of harmful emissions, the emission characteristics of automobile engines, the purification of automobile gasoline engines, the purification of automobile diesel engines, and the rear of automobile gasoline engines, treatment purification, automotive diesel engine after-treatment technology, automotive fuel and emissions, purification scheme, working principle of emission analyzer, emission regulations and emission measurement technology. According to the teaching content, the following four aspects of Workshop teaching research are carried out. Figure 1 is a schematic diagram of the knowledge involved in four specific teaching links.

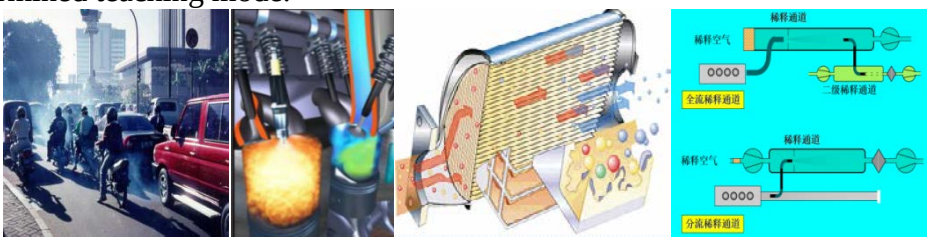
The generation mechanism of automobile pollutants: The main knowledge content in the

textbook includes the generation mechanism of the main pollutants CO, HC, NOx and particulates in automobile exhaust. The Workshop teaching method carries out the development process of related theories, the current status quo, and the development trend of related research based on this part of the content under the determined teaching mode.

Automotive gasoline engine internal purification: the main knowledge content in the textbook includes gasoline engine internal purification technology, including gasoline injection electronic control system and its impact on emissions, typical low-emission combustion systems and their impact on emissions. The Workshop teaching method carries out the development process of related theories, the current status quo, and the development trend of related research based on this part of the determined teaching mode.

Automotive gasoline engine after-treatment purification: The main knowledge content in the textbook includes the basic structure and working principle of the automotive gasoline engine after-treatment purification device, especially the three-way catalytic converter. The Workshop teaching method carries out the development process of related theories, the current status quo, and the development trend of related research based on this part of the determined teaching mode.

The working principle of the emission analyzer: The main knowledge content in the textbook includes the working principle of different types of automobile emission testers and their operation methods and precautions. The Workshop teaching method carries out the development process of related theories, the current status quo, and the development trend of related research based on this part of the determined teaching mode.



(a) (b) (c) (d)

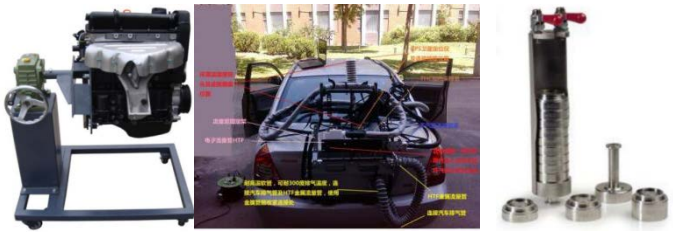
Fig.1 Schematic Diagram of Each Teaching Link

(a. Automotive exhaust emissions, b. Automotive gasoline engine internal purification, c. Automotive gasoline engine post-processing purification, d. Dilution sampling system)

3.3 Selection of Practical Teaching Links

The practical aspects of this course include engine structural disassembly and working principle analysis, automobile emissions and testing, etc. Fig. 2 shows part of the experimental platform and equipment used in the practice teaching link.

In terms of engine structural disassembly and working principle analysis, the workshop teaching mode is used to consolidate and strengthen the knowledge of automobile engine structure, master the structure of automobile emission-related equipment, and discuss its working principle and future development trends.



(a) (b) (c)

Fig.2 Part of the Experiment Platform in the Practice Teaching Session

(a. Gasoline engine disassembly experiment platform, b. SEMTECH ECOSTAR exhaust gas analyzer, c. Dekati® DLPI particulate matter sampler)

Automobile emission and testing: The practical testing equipment currently equipped in the

laboratory includes SEMTECH ECOSTAR exhaust gas analyzer and Dekati® DLPI particulate matter sampler. The Workshop teaching method carries out the development process of related theories, the current status quo, and the development trend of related research based on this part of the determined teaching mode.

3.4 Analysis of Teaching Effect

After carrying out the workshop teaching and learning of the above-mentioned links (theoretical teaching and practical teaching), the improvement of the teaching effect will be analyzed through classroom question and answer, final assessment, random interview and after-class interview.

Based on the above contents, the specific operation route of this teaching method reform is listed as shown in Figure 3.

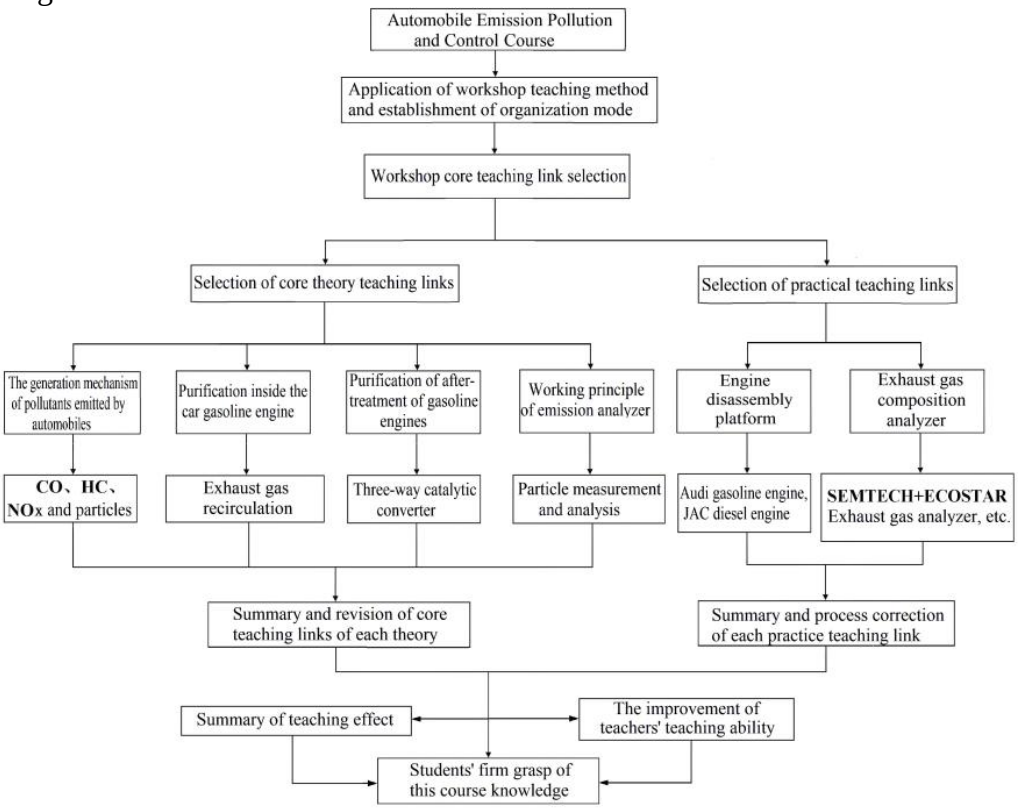


Fig.3 The Specific Operation Route of Teaching Method Reform

4. Conclusion

The “Workshop” are organized in the form of topics with a clear purpose. All course content is conducted around the topics proposed by the host. Teaching methods such as lectures, questioning and multimedia are used in the current teaching mode of “Automobile Emission Pollution and Control”. Students do not have a deep understanding of the core knowledge and cannot apply flexibly. Through the establishment of the course Workshop teaching model, this research uses the four theoretical knowledge points and two practical knowledge points of the course as the workshop themes to promote the transformation of students from passive learning to active interactive learning, further improve the teaching effect of the course, and enhance student research Ability to learn. At the same time, it also provides experience reference for curriculum reforms for other professional core courses and professional characteristic courses of engineering.

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