

# Research on the Teaching Reform of Automobile Disassembly and Installation Course for Vehicle Engineering Major

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**Abstract:** The practical course of automobile disassembly and installation is one of the main links for automobile structure courses of vehicle engineering major in colleges and also a comprehensive practical course. In order to improve the comprehensive quality of vehicle engineering major in colleges and the capacity to solve problems, based on the undergraduate cultivation target, this article starts from analyzing the current status of experimental course for automobile disassembly and installation and then puts forward corresponding reform measures by analyzing problems in the course.

## 1. Introduction

As one of the main links of automobile structure courses, the practice of automobile disassembly and installation is the only approach for students to sublimate their automobile structure knowledge. By automobile disassembly and installation, students can consolidate their learned theoretical knowledge, further get familiar with the complete vehicle performance, the basic knowledge of complete vehicle, the complete vehicle structure, engine structure and working principle, all vehicle assembly structures and working principles, the function of all vehicle components and parts as well as vehicle-related standards; By the practice of automobile disassembly and installation, it's aimed to realize the following contents among students: Master the method to use disassembly and installation tools and equipment, and be skilled at using equipment and tools for disassembly and installation, master the disassembly and installation methods and steps of complete vehicle and the assembly, get familiar with the connection relations of all automobile assemblies, basically master the adjustment methods and steps of complete vehicle, cultivate students' operational skills and manipulative capacity as well as their capacity to analyze and solve problems, and their innovative thinking capacity, and lay a solid foundation for studying follow-up professional courses. In this paper, for the objective of improving the teaching quality and efficiency of practical courses for automobile disassembly and installation, and cultivating qualified undergraduate applied engineering talents, it starts from the current teaching status of automobile disassembly and installation, and then discusses about measures of teaching reform for the practical course of automobile disassembly and installation [1].

## 2. Current Status and Analysis on Automobile Disassembly and Installation

The practical course of automobile disassembly and installation can be divided into the disassembly and installation of complete vehicle and the disassembly and installation of assemblies [2]. The disassembly and installation of complete vehicles can be divided into four plates: Vehicle body, chassis, engine, and electric equipment; general disassembly and installation include: Gearbox, clutch, brake, steering gear, and drive axle; the main contents and organization of the disassembly and installation include:

### 2.1 Safety Education

Safety first, before the disassembly and installation, it is requested to explain safety knowledge

to students, precautions for disassembly and installation as well as the specifications to use equipment and tools;

## **2.2 Implement by Groups**

Disassembly and installation should be implemented as per 6-8/group. Each group will disassemble the next part, install it, and then disassemble other parts, which should be implemented respectively by each group;

## **2.3 Cognition on Disassembly and Installation Equipment and Tools**

Before the disassembly and installation, the instructor should explain the operation of tools and equipment used in the disassembly and installation respectively, and demonstrate appropriately;

## **2.4 Cognition on Complete Vehicle**

The contents include: Vehicle type, vehicle logo, vehicle drive mode, layout mode, suspension type, and brake type;

## **2.5 Disassembly and Installation of Vehicle Body**

Disassembly and installation of engine hood, wheel fender, car door, and rear cover, etc.;

## **2.6 Disassembly and Installation of Chassis**

Disassembly and installation of the braking system, running system, transmission system, and steering system;

## **2.7 Disassembly and Installation of Electric Appliances and Auxiliary Facilities**

Disassembly and installation of air conditioning system, seat, instrument board, steering wheel, automotive lamp, etc.;

## **2.8 Engine Disassembly and Installation**

Disassembly of the engine from the complete vehicle and its installation;

## **2.9 Disassembly and Installation of the Assembly**

Disassembly and installation of the engine, gearbox, clutch, brake, steering gear, drive axle, etc.

## **2.10 Write Disassembly and Installation Reports**

The contents include: Objective, equipment and tools, process and contents of disassembly and installation, problem analysis and summary

## **3. Problems in the Practical Course of Automobile Disassembly and Installation**

Based on the above analysis on the current status of disassembly and installation course, it's easy to find out lots of problems in the course, which can be summarized as follows:

### **3.1 Unreasonable Disassembly and Installation Organization**

Students cannot well master automobile system knowledge based on the disassembly and installation in the current organization mode, and cannot fully understand the disassembly and installation of the complete vehicle because they only disassemble one part and then install it; The disassembly and installation lacks in flexibility. Students only disassemble one part and then install it, so in case of changing it into another vehicle, it's doubtful whether they can install the disassembled part; this cannot cultivate students' capacity to solve actual problems.

### **3.2 The Difficulty to Motivate Students' Creative Thinking**

By studying theoretical knowledge of automobile structure, students are eager to verify the knowledge taught in textbooks by disassembly and installation, so they can be quite enthusiastic and interested in joining the disassembly and installation experiments, but they will find it boring

while operating according to the guiding book, and cannot think independently, or unleash their subjective initiative, so they will find it difficult to participate in.

### **3.3 Relatively Simplified Disassembly and Installation Contents**

The current automobile disassembly and installation are mainly oriented to traditional gasoline vehicles. Besides, most vehicles are old types and are mainly disassembled and installed on the basis of two plates step by step. In most colleges, disassembly and installation experiments for the vehicle engineering specialty are disassembly and installation only, without other projects.

### **3.4 The Difficulty to Figure out the Connection Relations of Automobile Parts and Components**

Vehicles are generally connected by bolts or coordination, but most students only pay attention to disassembly and installation, rather than the connection between components, parts as well as the connection between components and parts, and cannot figure out the assembly relations after completing disassembly and installation experiments.

### **3.5 Unreasonable Evaluation Mode**

Currently, the evaluation basis is the daily performance and the experimental report of disassembly and installation, of which the daily performance includes: The attitude for disassembly and installation, disciplines, cleaning, disassembly and installation normalization; the experimental report of disassembly and installation includes: The tool and equipment used for disassembly and installation, the contents and process of disassembly and installation, and reflection questions. The evaluation is static, and such evaluation mode cannot reflect the students' creative thinking or innovative thinking or their capacity to solve actual problems.

## **4. Measures to Improve the Teaching of Practical Course for Automobile Disassembly and Installation**

Based on the above analysis on the current status of automobile disassembly and installation experiments, problems can be found in automobile disassembly and installation experiments, and the reform measures are put forward as follows considering the automobile disassembly and installation experiments of vehicle engineering specialty, to improve the efficiency, effect and effectiveness of automobile disassembly and installation experiments, exert the teaching effect of automobile disassembly and installation experiments in the vehicle engineering specialty, make students master knowledge effectively in disassembly and installation experiments, exercise their creative thinking and improve their capacity to solve actual problems:

### **4.1 Reasonable Organizational Form**

Reasonable organizational form can improve disassembly and installation efficiency and effect, unleash students' subjective initiative, innovation and creativity, and can promote to complete automobile disassembly and installation experiments and realize the experimental objective.

Dive into groups; first of all, the complete vehicle can be divided into four parts: Chassis, engine, vehicle body, electric appliances and accessories; each group will be engaged in the disassembly and installation of one part respectively with no influence on each other. Secondly, after grouping, specific work will be divided inside the group, and everyone has a clear responsibility and something to do by themselves. Thirdly, after grouping, it's also easier for teachers to provide guidance, organize and manage accordingly. Generally, a group is formed by 5 people, with one group leader, who should be responsible for borrowing and returning disassembly tools, cleaning, assigning tasks to each group member, and managing the group. The task assigned to each group member in the disassembly and installation includes: One person is responsible for recording videos of the disassembly and installation process, so students who still cannot fully understand the disassembly and installation can continue to watch the video after completing the experiment. Besides, such videos can also be saved as disassembly and installation data. One person should be

responsible for recording the name and model of all tools used in the disassembly and installation as well as the sequence of disassembly and installation. Two people are responsible for implementing the specific disassembly and installation. One person is responsible for transmitting components, parts and tools, etc., placing the disassembled components and parts at suitable places, and labeling the name of components and parts on corresponding parts during the disassembly and installation, so that students who are not so familiar with the name of components can recognize them at any time. Besides, such person is also responsible for transmitting required parts, and transmitting tools as per the demand of the operating student. Each role can be exchanged at a proper time. Implement disassembly and installation in groups based on the division of work. During disassembly and installation, each student is responsible for different work in different phases according to different divisions of work, and will be exercised comprehensively.

Implement disassembly and installation by turns; firstly, it is the disassembly and installation of complete vehicles. A group is formed by 5 people, who will share one car with another group and then disassemble and install different parts accordingly (if appropriate, one car can be assigned to each group), and when each group has completed the disassembly or installation, all groups should be transferred to the disassembly or installation of other parts until all groups have completed the disassembly and installation of the complete vehicle; Secondly, it's the disassembly and installation of assemblies, which should be implemented by two groups alternately, with one group in charge of the disassembly, while the other group in charge of the assembly. During the disassembly and installation, parts or components disassembled by each group should be installed by other groups, and students should think about the installation position and accuracy of components or parts during the installation, further get familiar with the structure and function of automobile parts and components, unleash students' subjective initiative, improve their capacity to master knowledge flexibly, and solve actual problems, and also fully exercise their manipulative capacity.

#### **4.2 Make Full Use of Multi-media Teaching**

On one hand, it's applicable to show videos about the production and general assembly of existing cars to students [3], so that they can get familiar with the general assembly process, components and parts, assembling tools, and equipment of cars, become interested in vehicle assembly, and improve their enthusiasm about automobile disassembly and installation; On the other hand, it's applicable to virtualize automobile disassembly and installation by computer simulation technology, combine it with classroom teaching and implement the virtual disassembly and installation of complete vehicle, engine, gearbox, and other relatively complicated assemblies in theoretical teaching. By using simulation technologies in virtual disassembly and installation, students can get familiar with the disassembly and installation process. It's easier to operate, and students can repeat the process until they can fully understand it. In virtual disassembly and installation, students can not only get familiar with automobile structure knowledge, but also the process and sequence of disassembly and installation, and further consolidate the theoretical knowledge about automobile structure. Moreover, it can also facilitate actual operation.

#### **4.3 Reinforce the Analysis Link of Components and Parts**

The disassembly and installation of complete vehicle and the assembly is not just simple disassembly and installation, emphasis should also be paid to the analysis on parts or components. Firstly, it is structural analysis, which should analyze the structure of complete vehicle, the effect and working principle of all parts by combing with theoretical knowledge about automobile structure, and the function of all assembly components as well as the structure of components, for instance, Analyzing the function of gasket and seal ring as well as the assembly relations between components, parts as well as between components and parts; Secondly, it is the analysis of the assembly process, which should analyze the assembly sequence of parts and components, the positioning reference of assembly, the tools and equipment required for installation and disassembly. Thirdly, it is the analysis of component process, which should analyze the material, thermal treatment and structural process of components. Further consolidate automobile structure knowledge, engineering material, etc. and lay a solid foundation on the automobile design course by

reinforcing the analysis link.

#### **4.4 Analysis on the Design of Typical Components**

It's applicable to choose typical components for mapping during the disassembly and installation, and then use three-dimensional software in the three-dimensional modeling of components, and analyze the structural characteristics and design characteristics of components by three-dimensional figures. By mapping, drawing and analysis, students can consolidate their engineering drawing knowledge, trained the application of three-dimensional software, learned the analysis of components from the perspective of design and laid a foundation for future automobile design courses.

#### **4.5 Inspection of Parts and Components**

Firstly, get familiar with automobile maintenance knowledge, and understand parts and components required for the maintenance of automobile assembly, such as, The cylinder hole and the junction surface between the cylinder and the cylinder cover should be inspected in engine maintenance, while the brake disc should be inspected in the maintenance of disc brake, to lay a foundation for future maintenance. Secondly, get familiar with the inspection contents of components and parts, and then understand the technical status of automobile components and parts by the inspection of components and parts, and then check whether the technical conditions can meet technical requirements, such as, The cylindricity of engine cylinder, the flatness of junction surface between the cylinder and the cylinder cover, the thickness of brake disc for the disc brake, the parallelism and flatness at the two sides of the disc; thirdly, get familiar with the testing equipment and the measuring tool, such as, The clearance gauge used to measure the clearance, the centimeter used to measure the flatness, the dial gauge or micrometer used to measure the thickness, and the general measuring tool, vernier caliper.

#### **4.6 Automobile Adjustment**

Adjustment should be made to automobiles after disassembly and installation, to meet the required technical conditions for automobiles [4]. First of all, it is requested to get familiar with the automobile adjustment positions, for instance, Adjustment should be made after the installation of clutch pedal, accelerator pedal, and brake pedal; secondly, it's requested to get familiar with the adjustment contents, for instance, The free stroke of the clutch pedal should be adjusted; thirdly, it's requested to get familiar with the adjustment methods, for instance, The method to adjust the free stroke of the clutch: Firstly, check whether the free stroke is within the stipulated scope, put a straight steel ruler on the pedal of the cab, measure the height of pedal under complete relaxation at first, and then gentle press the pedal, and re-measure the pedal height when resistance increases, and the difference of the two heights is the free stroke of the pedal. If the free stroke of the clutch pedal cannot meet requirements, adjustments should be made. For hydraulic control mechanism, the free stroke of the pedal is generally adjusted by adjusting the length of the push rod for the master cylinder, and then unscrews its locking nut, and then rotating the push rod for the master cylinder. The locking nut will be tightened after adjustment is made. By automobile adjustments, students can master automobile maintenance skills.

#### **4.7 Cognition on New Energy Vehicles**

Traditional disassembly and installation practices are mainly oriented to oil-fueled automobiles, and with the social progress, the development of automobile technologies and the requirements for environment, new energy vehicles have emerged at the right time. The difference between new energy vehicles and traditional vehicles is the power system. The automobile power system is formed by power source and drive system. The power system of traditional vehicles consists of diesel engine and drives system, while the power system of new energy vehicles consist of electromotor and power (hydrogen cell) or formaldehyde fuel engine, etc. and the drive system, so the cognition on new energy vehicles should mainly focus on the power source of vehicles.

#### **4.8 Reasonable Evaluation Method**

In respect of the traditional evaluation method, the performance during disassembly and installation accounts for 40% [5], and the disassembly and installation report accounts for 60%, which is a single mode and cannot evaluate students comprehensively or reflect innovative and creative evaluation contents. Disassembly and installation competitions, process questions, knowledge quiz, barrier setup and solution links are added on the basis of the former evaluation basis and ratios of all links are adjusted as follows: Performance (10%), report (40), competition (15%), questions (10%), quizzes (10%), solutions (15%), which can help improve students' innovation capacity, creativity, and their capacity to solve actual problems.

#### **5. Conclusion**

The automobile disassembly and installation of vehicle engineering specialty has rich practical course contents, and involves rich knowledge, so it is requested to well organize, reasonably arrange disassembly and installation contents and evaluate reasonably in the disassembly and installation process, so that students can learn more knowledge, master the automobile disassembly and installation steps, get familiar with automobile adjustment methods and the inspection methods of automobile parts as well as the use of equipment, gauge and measuring tools within limited time range.

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