# Development and Application of an Intelligent Teaching Resource Database in Automotive Maintenance Remote Practical Training

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**Abstract:** This paper focuses on the development and application of intelligent teaching resource databases in the field of automotive maintenance remote practical training. It first elaborates on the new requirements for professionals in the automotive maintenance industry and the limitations of traditional practical training models, emphasizing the necessity of developing intelligent teaching resource databases. It then details the development process of such a database, including architectural design, content planning, and technical implementation. Following this, it delves into its application in automotive maintenance remote practical training, such as enhancing training effectiveness, promoting personalized learning, and achieving resource sharing. Finally, it analyzes potential challenges in the application process and proposes corresponding solutions. The aim is to provide more efficient and high-quality teaching support for automotive maintenance remote practical training and promote the development of automotive maintenance professional education.

**Keywords:** Intelligent; Teaching resource database; Automotive maintenance; Remote practical training

## 1. Introduction

With the rapid development of automotive technology, the requirements for professionals in the automotive maintenance industry are increasing. Modern automotive maintenance not only requires mastery of traditional mechanical repair skills but also knowledge in areas such as electronic technology and computer technology. Traditional automotive maintenance practical training models primarily rely on on-campus training workshops and on-site teaching. These models are limited by time and space, and teaching resources are relatively scarce, making it difficult to meet the diverse learning needs of students and the demands of the industry´s rapid development.

Remote practical training, as an emerging teaching model, leverages modern information technology to break through time and space limitations, providing students with more flexible learning methods. The intelligent teaching resource database, as a crucial support for remote practical training, can integrate rich teaching resources, provide personalized learning services, and improve training effectiveness. Therefore, the development and application of an intelligent teaching resource database are of significant importance for automotive maintenance remote practical training.

## 2. Necessity of Developing an Intelligent Teaching Resource Database

### 2.1 Adapting to the Development Needs of the Automotive Maintenance Industry

Modern automobiles integrate a large number of electronic control systems and intelligent technologies, such as engine electronic control systems, automatic transmissions, and vehicle electronic stability systems. Automotive maintenance personnel need solid knowledge in electronic technology, computer programming, and fault diagnosis to accurately judge and repair vehicle faults. An intelligent teaching resource database can integrate the latest automotive maintenance technical materials, case studies, virtual simulation experiments, and more, helping students stay updated on industry trends and technological developments, thereby improving their professional

skills and comprehensive quality to meet industry demands.

### 2.2 Addressing the Limitations of Traditional Practical Training Models

Traditional automotive maintenance practical training is limited by factors such as venue, equipment, and teaching staff. Students have limited training opportunities and may struggle to encounter various types of vehicle faults and maintenance scenarios. Furthermore, traditional practical training mainly follows a teacher-demonstration, student-imitation approach, lacking interactivity and personalization, which is not conducive to cultivating students' innovative thinking and problem-solving abilities. An intelligent teaching resource database can provide rich virtual training scenarios and interactive learning tools, allowing students to conduct practical operations and learning anytime, anywhere, thereby increasing training opportunities and enhancing learning autonomy and motivation.

### 2.3 Promoting the Sharing and Optimal Allocation of Educational Resources

Teaching resources for automotive maintenance majors vary across regions and institutions. Some schools may possess advanced teaching equipment and excellent faculty, while others may be relatively lacking. An intelligent teaching resource database can facilitate the sharing of teaching resources, allowing high-quality resources to be disseminated and applied more widely, thereby promoting educational equity. Simultaneously, by integrating and optimizing teaching resources, it can improve resource utilization efficiency and avoid redundant construction and waste.

## 3. Development of an Intelligent Teaching Resource Database

### 3.1 Resource Database Architecture Design

The intelligent teaching resource database should adopt a layered architecture design, including the data layer, support layer, application layer, and user layer. The data layer is primarily responsible for storing various teaching resources, such as text, images, videos, animations, and virtual simulation models. The support layer provides basic services like resource management, user management, permission management, and search engines. The application layer implements various teaching functions, such as online learning, virtual practical training, examination and assessment, and communication and interaction. The user layer serves different user groups, including students, teachers, and enterprise personnel, providing personalized user interfaces and services.

### 3.2 Content Planning

This includes fundamental theoretical knowledge related to automotive maintenance, such as automotive structure, automotive electronic technology, and automotive maintenance processes. This knowledge can be presented in formats like text, images, and videos to facilitate student understanding and mastery. Provide operational videos and virtual simulation experiments for various automotive maintenance training projects, such as engine disassembly and assembly, and automotive fault diagnosis and troubleshooting. Students can learn operational steps and techniques by watching videos and practice through virtual simulation experiments to improve their hands-on abilities. Collect and organize a large number of actual automotive maintenance cases, including fault phenomena, cause analysis, repair methods, and experience summaries. By analyzing and discussing cases, students' fault diagnosis and problem-solving abilities can be cultivated. Timely update information on the latest technologies, policies and regulations, and market trends in the automotive maintenance industry, helping students understand industry development trends and broaden their horizons.

### 3.3 Technical Implementation

Use a relational database management system, such as MySQL or Oracle, to store and manage

teaching resources. By rationally designing the database table structure, ensure data consistency and integrity and improve data query efficiency. Use professional multimedia processing software, such as Adobe Premiere and Adobe After Effects, to edit and process resources like videos and audio, enhancing resource quality and visual appeal. Utilize Virtual Reality (VR) and Augmented Reality (AR) technologies to develop automotive maintenance virtual simulation experiment systems. Students can immerse themselves in practical operations by wearing VR devices or using AR applications, enhancing the immersive and realistic feel of learning. Adopt a high-speed and stable network architecture to ensure the access speed and stability of the teaching resource database. Simultaneously, develop mobile client applications, allowing students convenient access to the resource database for learning via smartphones or tablets anytime, anywhere.

## 4. Application of the Intelligent Teaching Resource Database in Automotive Maintenance Remote Practical Training

### 4.1 Enhancing Practical Training Effectiveness

The intelligent teaching resource database provides rich virtual training scenarios and interactive learning tools. Students can repeatedly practice in virtual environments, familiarize themselves with training procedures and operational techniques, and reduce errors during actual operations. Additionally, the case study resources and industry trend resources within the database can help students broaden their knowledge base and improve their fault diagnosis and problem-solving abilities, thereby enhancing practical training effectiveness.

### 4.2 Promoting Personalized Learning

The resource database can provide personalized learning recommendations and plans based on students´ learning progress, abilities, and interests. Students can choose learning resources and methods that suit their needs, achieving self-directed learning and personalized development. Furthermore, the resource database supports online communication and Q&A functions, allowing students to seek help from teachers and peers at any time, promoting interactive learning and exchange.

### 4.3 Realizing Resource Sharing

The intelligent teaching resource database breaks through time and space limitations, enabling the sharing of teaching resources. Students from different regions and institutions can share high-quality teaching resources, promoting educational equity. Simultaneously, enterprises can upload real-world cases and technical materials to the database for educational use, strengthening cooperation and exchange between schools and enterprises.

## 5. Challenges and Solutions in the Application Process

### 5.1 Technical Challenges

The development and application of an intelligent teaching resource database rely on advanced information technologies, such as virtual simulation technology and network technology. Currently, these technologies still have some shortcomings; for example, the realism and interactivity of virtual simulation experiments need improvement, and network bandwidth can limit resource transmission speed. Solutions: Increase investment in research and development of relevant technologies, continuously improve technological capabilities, and enhance the performance and quality of the resource database. Simultaneously, strengthen the construction of network infrastructure to improve bandwidth and stability.

### 5.2 Resource Quality Issues

Although an intelligent teaching resource database can integrate a large amount of teaching

resources, the quality of these resources varies. Some resources may be outdated, incorrect, or inaccurate, affecting students' learning outcomes. Solutions: Establish a strict resource review mechanism to audit and filter resources uploaded to the database, ensuring resource quality and accuracy. Encourage teachers and industry professionals to actively participate in resource construction and updates to maintain the timeliness and practicality of resources.

### 5.3 Teachers' Information Technology Competency Issues

The application of an intelligent teaching resource database requires teachers to possess certain information technology competencies, such as multimedia production, virtual simulation experiment development, and the use of online teaching platforms. Currently, the information technology skills of some teachers need improvement, affecting the effective application of the resource database. Solutions: Strengthen information technology training for teachers to enhance their application level. Establish platforms for teacher exchange and mutual assistance to promote experience sharing and technical communication among teachers.

### 5.4 Students' Self-Directed Learning Ability Issues

The intelligent teaching resource database provides opportunities for self-directed learning, but some students lack self-directed learning abilities and self-discipline, preventing them from fully utilizing the database for learning. Solutions: Strengthen guidance for students on self-directed learning to cultivate their awareness and abilities in this area. Establish learning incentive mechanisms to reward and recognize students with outstanding learning performance, stimulating their learning motivation.

## 6. Conclusion

The development and application of an intelligent teaching resource database in automotive maintenance remote practical training hold significant practical importance. It can adapt to the development needs of the automotive maintenance industry, address the limitations of traditional practical training models, and promote the sharing and optimal allocation of educational resources. Through reasonable architectural design, content planning, and technical implementation, the intelligent teaching resource database can provide students with rich learning resources and personalized learning services, enhance practical training effectiveness, and promote the comprehensive development of students. However, challenges related to technology, resource quality, teachers' information technology competency, and students' self-directed learning abilities may arise during the application process, requiring corresponding solutions to overcome them. In the future, with the continuous development and innovation of information technology, intelligent teaching resource databases will be continually improved and optimized, providing more efficient and high-quality teaching support for automotive maintenance remote practical training and promoting the development of automotive maintenance professional education.

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