

Exploration of Teaching Reform for the Course "Intermediate Automotive Maintenance Technician" under the New Engineering Education Framework

Huadong Zang

Suzhou Vocational Institute of Industrial Technology, Suzhou, 215104, China

How to cite this paper: Zang, H. (2026). Exploration of teaching reform for the course "Intermediate Automotive Maintenance Technician" under the new engineering education framework. Social Sciences and Humanities, 5(3), 38–44. ISSN Print: 3104-4328, ISSN Online: 3104-4336. <https://doi.org/10.63313/SSH.2012>
Published: 2026-10-20

Copyright © 2026 by author(s) and Erytis Publishing Limited.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
<http://creativecommons.org/licenses/by/4.0/>



Abstract

The initiative of "New Engineering Education" emphasizes that engineering education should align with new industrial technologies and emerging business models, aiming to cultivate interdisciplinary technical and skilled talents who possess both practical engineering capabilities, innovative thinking, and professional ethics. "Intermediate Automotive Maintenance Technician" is a core practical course for automotive-related programs to meet vocational skill level assessment requirements. However, traditional teaching approaches have faced several challenges, including curriculum content lagging behind automotive technological advancements, a disconnect between theoretical knowledge and practical application, limited evaluation methods, and insufficient cultivation of students' innovative capabilities. Grounded in the principles of "New Engineering Education" and in response to the developmental needs of the new energy vehicle and intelligent connected vehicle industries, this paper explores teaching reforms from five key dimensions: restructuring course objectives, optimizing teaching content, innovating teaching models, developing practical training platforms, and establishing diversified evaluation systems. The objectives of this research are to enhance the quality of course instruction and cultivate intermediate-level automotive maintenance technical professionals who meet the demands of the automotive industry.

Keywords

New Engineering Education; Intermediate Automotive Maintenance Technician; Teaching reform; Skill cultivation; Industry-education integration

Introduction

With the rapid transformation of the automotive industry toward electrification, intelligence, and connectivity, traditional automotive repair roles in the fuel-powered vehicle sector are gradually evolving toward areas such as new energy

vehicle (NEV) inspection, complete-vehicle fault diagnosis, and in-vehicle electrical system maintenance. The initiative for "New Engineering Education" requires vocational education to break down traditional disciplinary barriers, align with authentic workplace tasks in the industry, and strengthen the cultivation of practical capabilities, engineering thinking, and continuous learning capacities. The course "Intermediate Automotive Repair Technician" is designed with the goal of enabling students to obtain the intermediate vocational skill certification in automotive repair; it serves as a critical bridge between foundational academic courses within educational institutions and real-world industrial roles. Conventional teaching methods have predominantly focused on fuel-powered vehicle repair projects, employing outdated teaching materials and instructional approaches centered on teacher demonstrations and student imitation. Such approaches emphasize procedural operations while neglecting fault diagnosis logic analysis, making them inadequate to meet the talent demands of the automotive industry under the framework of "New Engineering Education." Therefore, implementing curriculum and teaching reforms—by integrating traditional automotive repair knowledge with emerging technologies for new energy vehicles and restructuring the curriculum system—holds significant practical importance.

1. Current Major Issues in the Curriculum

1.1. Outdated Teaching Content and Insufficient Integration of New Technologies

The existing curriculum primarily focuses on traditional internal combustion engine, chassis, and electrical system maintenance, while incorporating limited content related to new engineering disciplines—such as high-voltage safety in new energy vehicles, power battery testing, motor maintenance, and in-vehicle intelligent system diagnostics. This misalignment with current industry demands results in students lacking sufficient knowledge when undertaking maintenance tasks on new energy vehicle models after graduation.

1.2. Disconnection Between Theoretical and Practical Training, and Weak Development of Engineering Thinking

Traditional classroom instruction follows a pattern of centralized theoretical lectures followed by intensive practical sessions; however, theoretical knowledge tends to be abstract and tedious, while practical training often consists of standardized verification tasks—such as following fixed procedures for disassembly, assembly, and maintenance—without authentic fault scenarios. Consequently, students merely follow prescribed steps, lacking the logical reasoning for fault diagnosis, systematic analysis capabilities, and innovative problem-solving skills, which fails to meet the requirements for cultivating engineering competencies under the new engineering education framework.

1.3. Monotonous Teaching Models and Insufficient Student Agency

Classroom instruction predominantly relies on teacher-led lectures and demonstrations, leaving students in a passive role to merely imitate procedures, with limited opportunities for group collaboration or project-based exploration. Furthermore, the limited number of practical training workstations forces students to rotate through tasks, resulting in insufficient hands-on practice time. This situation dampens student motivation and hinders the development of autonomous inquiry capabilities.

1.4. Limited Assessment Methods and Overemphasis on Outcomes Over the Process

Current assessment mechanisms primarily consist of a final practical examination combined with a theoretical written test, with certification exam standards serving as the sole benchmark. This approach prioritizes operational outcomes while neglecting comprehensive evaluations of learning processes, adherence to safety protocols, professional ethics, teamwork skills, and fault analysis methodologies—thereby failing to holistically measure the integrated engineering literacy required under the new engineering education paradigm.

1.5. The integration of industry and education remains insufficient, and practical training conditions are constrained

On-campus training equipment predominantly consists of outdated fuel-powered machinery, while the number of new energy vehicle training rigs is inadequate; frontline technical cases from enterprises are difficult to integrate into classroom instruction on a regular basis, instructors lack firsthand practical experience with new technologies in industrial settings, and there is a gap between teaching cases and actual maintenance scenarios in the industry.

2. Approaches and Implementation Pathways for Curriculum Teaching Reform under the New Engineering Education Framework

2.1. Reconfigure course objectives to align with professional requirements and the educational goals of new engineering disciplines.

Guided by the core principles of "emphasizing practical training, prioritizing innovation, and aligning with industrial needs" of New Engineering Education, and in conjunction with the vocational skill standards for intermediate automotive maintenance technicians, this curriculum framework establishes three tiers of learning objectives: Knowledge objectives: mastery of knowledge regarding conventional internal combustion engine vehicle maintenance and fault diagnosis; proficiency in high-voltage safety regulations for new energy vehicles and the fundamental principles of the "three-electric" systems; and an understanding of the

basics of intelligent onboard systems. Skill objectives: attainment of the skill level required of an intermediate automotive maintenance technician, including the ability to independently perform vehicle maintenance, complete assembly inspections, and conduct fault diagnosis, as well as possessing foundational capabilities for new energy vehicle testing. Professional competency objectives: cultivation of engineering safety awareness and adherence to professional standards; development of systematic fault diagnosis thinking, teamwork skills, problem-solving capabilities, and lifelong learning abilities—thereby meeting the professional competency requirements for modern automotive maintenance roles.

2.2. Optimize course content by adopting modular restructuring and integrating emerging automotive technologies.

Moving beyond the traditional discipline-based chapter structure, this curriculum adopts a project-based and modular approach to organizing teaching content, leveraging real-world automotive industry work tasks. It seamlessly integrates conventional automotive repair projects with emerging technologies for new energy vehicles (NEVs): - **Basic Safety Module**: Automotive repair safety, high-voltage safety standards for NEVs, and the use of diagnostic tools (multimeters, oscilloscopes, and diagnostic scanners); - **Conventional Vehicle Repair Module**: Secondary vehicle maintenance, engine overhaul, chassis overhaul, and diagnostic procedures for conventional electrical systems (while retaining core assessment items for intermediate-level technicians to meet certification requirements); - **NEV Extension Module**: Exterior and insulation inspection of power batteries, basic inspection of drive motors, troubleshooting of charging systems, and comprehensive maintenance of NEV vehicles; - **Integrated Fault Diagnosis Module**: Comprehensive troubleshooting across multiple vehicle systems, simulation of real-world automotive repair work orders, and cultivation of logical diagnostic reasoning skills. Additionally, this curriculum incorporates authentic automotive repair case studies from industry practitioners, eliminates obsolete content, and includes extended modules on basic perception technologies for intelligent vehicles and new in-vehicle diagnostic technologies—aligning closely with the technological trends of the "New Engineering" paradigm.

2.3. Innovate teaching models by advancing the integration of theoretical and practical instruction with project-based learning.

Integrated Theory-Practice Classroom: By integrating the classroom environment with practical training facilities, this approach allows students to learn, observe, and practice simultaneously. Theoretical knowledge points are seamlessly integrated with hands-on operational tasks, thereby transforming the traditional segmented teaching model that separates theory from practice. Virtual simulation software is utilized to conduct rehearsals for high-voltage hazardous operations, thereby

mitigating training risks. **Project-Driven Teaching:** Using maintenance work orders as the project framework, students are assigned specific fault-solving tasks. Working in small groups, they complete the entire workflow—including vehicle reception, fault diagnosis, plan formulation, inspection and repair, quality verification, and work order delivery—thereby simulating real-world corporate maintenance workflows. This approach guides students to independently analyze faults and cultivate their ability to solve engineering problems. **Blended Learning:** Through a dedicated learning platform, students upload micro-lectures, maintenance videos, and virtual simulation resources to review theoretical principles before class and operational key points after class. During class sessions, the focus shifts to hands-on training, group discussions, and debates on fault resolution strategies, effectively implementing a flipped classroom model.

2.4. Enhance practical training facilities, deepen the integration of industry and education, and establish a practical training environment for new engineering disciplines.

Integrated Virtual-Physical Training Platform: Upgrading training facilities by adding new training stations for new energy vehicles, complete-vehicle testing stations, and high-voltage testing equipment; complementing this with an automotive virtual simulation system, where simulations are conducted first for high-voltage, high-cost, and easily damaged components before transitioning to actual vehicle operations—thereby addressing challenges such as equipment shortages and high training risks. **Enhancing university-enterprise collaborative talent development:** inviting senior technicians from enterprises to deliver lectures on new technologies and provide hands-on guidance during training sessions; encouraging faculty members to regularly engage in enterprise internships to update their technical knowledge; integrating authentic fault case studies, repair standards, and work order management systems from enterprises into classroom instruction; and organizing short-term on-the-job observation programs for students to gain firsthand experience of actual workplace operations.

2.5. Establish a diversified process-based evaluation system and implement comprehensive competency assessments.

We are reforming the "final-exam-only" assessment model by establishing a diversified evaluation system comprising formative assessment and summative assessment, balancing the requirements for skill certification with the evaluation of comprehensive competencies for new engineering disciplines: **Formative assessment (60%):** includes classroom attendance, adherence to safety protocols, completion of work orders, group task performance, hands-on training performance, fault analysis plans, online learning activity, and professional ethics; **Summative assessment (40%):** consists of a theoretical written exam and a practical assessment, conducted in accordance with the national skill standards for intermediate

automotive repair technicians, to evaluate core skill proficiency. The evaluation process involves multiple evaluators: a combination of teacher evaluations, peer evaluations within groups, and student self-evaluations, ensuring that the focus extends beyond repair outcomes to include fault analysis reasoning, safe operational practices, and adherence to standardized procedures.

3. Outcomes of the Reform and Reflections

3.1. Outcomes of the Reform

Through teaching practice, students' initiative in learning has significantly increased, their logical thinking for fault diagnosis has been honed, and their pass rate for intermediate-level technician certification has remained stable; students have now acquired foundational skills in new energy vehicle inspection and have enhanced their job-readiness; teachers have improved their capabilities in project-based teaching and instruction of new technologies, have gained access to richer course resources, and have begun to establish a course teaching model aligned with the principles of New Engineering Education.

3.2. Existing Issues and Reflections

The initial investment in new energy training equipment is high, and the available equipment volume often fails to meet the demands of large-class teaching; project-based teaching imposes stringent requirements on teachers' comprehensive capabilities, necessitating ongoing faculty training; designing teaching projects presents significant challenges, as balancing the certification requirements for intermediate-level technicians with the integration of new technologies in new engineering disciplines requires continuous optimization of project cases. Moving forward, we will further deepen university-industry collaboration, develop school-based modular textbooks, regularly update teaching projects, and enhance the virtual simulation resource repository, thereby further elevating the quality of curriculum-based talent development.

4. Conclusion

Against the backdrop of the New Engineering Education initiative and the electrification transformation of the automotive industry, the curriculum reform of the "Intermediate Automotive Maintenance Technician" course should not solely focus on traditional maintenance skills and certification assessments. Instead, it must align with evolving industry job requirements by redefining course objectives, updating instructional content, and adopting project-based teaching models that integrate theoretical and practical learning. By leveraging the integration of industry and education as well as diversified evaluation mechanisms, this reform aims to ensure that students achieve intermediate technical proficiency while cultivating technically skilled professionals equipped with systematic thinking, innovative

awareness, and the adaptability to new automotive technologies—thereby supplying the automotive industry with versatile automotive maintenance talents who meet the standards of New Engineering Education.

Fund Project: 2021 Teaching Innovation Team of Suzhou Vocational Institute of Industrial Technology (No. 2021)XTD004)

References

- [1] Zhang Xiangheng. Research on Practical Teaching Reform in Automotive-related Majors under the Context of New Engineering [J]. Vocational Education, 2023.
- [2] Li Jianyong. Teaching Practice of Integrated Theory and Practice Courses for Intermediate Automotive Maintenance Technicians [J]. Automotive Education, 2022.
- [3] Wang Fang. Construction of an Industry-Education Integration Practical Training System for New Energy Vehicle Technology Majors [J]. China Vocational and Technical Education, 2021.