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Construction of a Layered Teaching Model for Higher Vocational Automobile Inspection and Maintenance Courses Guided by Skills Competition

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Abstract

In response to problems such as skills competition resources being concentrated on serving a small number of students, unified teaching tasks being difficult to adapt to student differences, and evaluation overemphasizing operational results, a layered teaching model for higher vocational automobile inspection and maintenance courses guided by skills competition is constructed based on competency orientation, work-process orientation, and performance assessment. This model coordinates competition standards, job competencies, and course objectives, and forms a closed loop of "diagnosis—implementation—evaluation—improvement" through learning situation diagnosis, three-level task layering, classified guidance, dynamic progression, and multiple evaluation. The model adheres to the unity of safety, standardization, and quality bottom lines, supports the development of all students through the progression of task comprehensiveness and diagnostic independence, and provides a reference for bringing competition resources into regular classrooms.

Keywords

Skills Competition; Automobile Inspection and Maintenance Course; Layered Teaching; Competition-Education Integration; Performance Assessment

Introduction

Skills competitions are an important vehicle for vocational education to connect with industrial technical requirements and promote the growth of skilled talents. Their function should further shift from contestant selection and performance display toward specialty construction, curriculum reform, and the development of all students. Relevant research advocates integrating competition projects, content, and evaluation requirements into course teaching, transforming competition

outcomes from training resources for a small number of students into popularized teaching resources [1], and establishing stable connections among competition standards, teaching projects, and course evaluation [2].

Existing research mainly focuses on competition-education integration, competition resource transformation, and course teaching design, proposing to select competition resources according to teaching requirements, transform competition tasks into learning projects, and develop supporting textbooks, work orders, and digital resources [3-8]. Research in the field of automobile inspection and maintenance emphasizes the collaborative cultivation of standardized operation and diagnostic thinking [9], while research on work-process-oriented courses provides a foundation for task organization, scenario creation, and process evaluation [10-11]. However, how to set progressive tasks according to student differences, avoid the solidification of layering, and use learning evidence to support dynamic progression still requires in-depth exploration.

Based on this, this paper combines competition resource transformation with layered teaching in automobile inspection and maintenance courses, analyzes practical demands and construction principles, and builds an operational mechanism from aspects such as learning situation diagnosis, task layering, teaching organization, learning evaluation, and feedback improvement.

1. Practical Demands for Implementing Layered Teaching in Higher Vocational Automobile Inspection and Maintenance Courses

1.1. Contradiction between the concentrated use of competition resources and the requirement for the development of all students

Skills competition training tasks have high comprehensiveness, high operational precision requirements, and high training intensity, while regular courses need to balance the knowledge learning, skill formation, and professional literacy of all students. If competition training is directly moved into the classroom, it may exceed the foundation of some students and will also be constrained by equipment, faculty, and class hour conditions.

Existing research has pointed out that high-quality faculty, training equipment, and competition resources tend to be concentrated on serving a small number of students [2-4]. The focus of skill competitions in leading curriculum reform is not to expand the scale of competition training, but to select and reorganize tasks, standards, and error cases that have universal teaching value. Through differentiated allocation of task difficulty and learning support, competition resources can be transformed into curriculum resources that all students can enter, complete, and advance through.

1.2. There is a contradiction between unified teaching tasks and differences in student abilities

Automotive maintenance tasks are comprehensive in nature. Students not only need to operate according to standards, but also need to consult materials, read circuit diagrams, select testing equipment, interpret data, verify conclusions, and complete quality inspections. Weakness in any one link may affect the completion of the task.

Unified tasks, unified guidance, and unified pacing can easily cause students with weak foundations to rely on demonstrations or have peers do the work for them, and it is also difficult to meet the deep learning needs of more capable students. Based on the basic standards, comprehensive application, and complex problem-solving requirements in competitions, comprehensive competition items can be restructured into progressive tasks, enabling students to receive support appropriate to their abilities under unified safety and quality standards.

1.3. There is a contradiction between evaluation that overemphasizes operational results and the requirements for cultivating diagnostic abilities

The quality of automotive maintenance is reflected not only in whether the fault is eliminated, but also in operational safety, testing plans, data basis, and maintenance verification. If evaluation only focuses on the final result, it is difficult to reflect students' diagnostic processes and impossible to accurately identify the true abilities of each student in group work.

Relevant research has already incorporated operational standards, diagnostic thinking, and professional qualities into automotive maintenance teaching [9]. Therefore, differentiated instruction should also simultaneously reform evaluation content and forms of evidence.

2. Basis and principles for constructing a differentiated teaching model led by skill competitions

2.1. Objective basis: coordination of competition item standards, job competencies, and course objectives

The objective basis of differentiated instruction includes competition item standards, job competencies, and course objectives. Competition item standards provide technical specifications and evaluation references, job competency analysis ensures task authenticity and professional norms, and course objectives define teaching content and depth based on talent cultivation requirements and students' learning patterns. The three are interrelated but cannot replace one another.

Competition item standards cannot directly replace course standards, and the high difficulty, high intensity, and specialized equipment requirements of competitions should not become uniform requirements for all students. Curriculum designers should establish a mapping relationship among the three, select content with teaching value, and transform it into differentiated objectives, so that competition resources serve the educational goals of the curriculum [5-7].

2.2. Theoretical Basis: Competency-Based, Work-Process-Oriented, and Performance Assessment

Competency-based vocational education is oriented toward the comprehensive competencies required to complete occupational activities. Tiered instruction in automobile inspection and repair should simultaneously focus on standardized operation, diagnostic reasoning, quality verification, teamwork, and service communication, avoiding equating high-level skills with operational speed or proficiency in a single task.

Work-process-oriented curricula emphasize organizing learning around typical tasks, linking the learning process to information, planning, implementation, checking, and evaluation [10-11]. Tasks at each level should retain the complete work process; the foundational level should not be reduced to mechanical imitation, nor should the challenge level be understood as a simple increase in operational items.

Performance assessment judges students' ability levels based on their performance and artifacts in complex tasks. Diagnostic plans, inspection records, data interpretation, repair work orders, and delivery explanations can all serve as assessment vehicles and provide a basis for adjusting learning levels and instructional support.

2.3. Construction Principles: Unified Standards, Progressive Tasks, Dynamic Adjustment, and Full Participation

The model construction should follow four principles: first, unified standards, with all levels implementing consistent safety, standardization, and quality bottom lines; second, progressive tasks, where level differences are reflected in situational complexity, diagnostic independence, and transfer requirements; third, dynamic adjustment, where learning levels are changed promptly based on task performance; and fourth, full participation, ensuring that every student undertakes substantive tasks through role rotation, individual evidence, and individual assessment.

3. Structure and Operational Mechanism of the Tiered Teaching Model for Higher Vocational Automobile Inspection and Repair Courses

This model is premised on the pedagogical transformation of competition resources, forming an operational structure of "learning situation diagnosis—task tiering—teaching organization—learning assessment—feedback improvement." Learning situation diagnosis provides the basis for task allocation, three-tier tasks carry students' progression, differentiated organization ensures implementation, performance assessment forms competency evidence, and feedback improvement drives continuous adjustment of tasks and support.

3.1. Learning Situation Diagnosis: Forming the Evidence Base for

Dynamic Tiering

Learning situation diagnosis aims to identify the support students need to complete tasks, rather than fixing student labels. Diagnostic content includes foundational knowledge of inspection and repair, reference material retrieval, circuit diagram reading, equipment use, data interpretation, safety awareness, and prior task performance. In addition to knowledge tests, it should also incorporate operational observation, learning work orders, and task artifacts, avoiding judging practical ability solely on the basis of theoretical scores.

Learning diagnosis can be divided into initial diagnosis, process observation, and stage review, which are used respectively to determine the task starting point, identify specific difficulties, and judge advancement conditions. The diagnosis results are used only to configure tasks, scaffolds, and guidance methods, and are not used as a basis for fixed class placement or public ranking.

3.2. Task Tiering: Constructing a Three-Level Progressive Maintenance Task Chain

Competition comprehensive tasks should be screened according to authenticity, typicality, safety, teachability, and implementability, and then decomposed and reorganized according to the complete work process to form three levels: basic proficiency, comprehensive application, and challenge advancement. The specific structure is shown in Table 1.

Table 1. Basic Structure of the Three-Level Progressive Maintenance Tasks

Task Level	Main Task Characteristics	Teaching Support Methods	Main Learning Evidence
Basic Proficiency	Clear task boundaries, relatively concentrated fault factors, and clear operational requirements	Provide process prompts, resource indexes, operational demonstrations, and necessary error correction	Inspection records, standardized operational performance, and basic diagnostic conclusions
Comprehensive Application	Requires comprehensive analysis of fault information, independent selection of testing methods, and completion of maintenance verification	Provide necessary maintenance resources, reduce step prompts, and strengthen plan guidance	Diagnostic plans, data interpretation, hypothesis verification, and maintenance work orders
Challenge Advancement	Complex situational information, requiring comparison of diagnostic paths and handling of transfer problems	Mainly provide safety and quality bottom-line guidance, and support independent inquiry	Plan comparison, complete evidence chains, optimization suggestions, and delivery explanations

The basic proficiency level focuses on standardized operations and basic diagnosis, the comprehensive application level focuses on independently formulating plans and using data to form conclusions, and the challenge advancement level focuses on solving complex problems, path optimization, and experience transfer. After completing a certain level, students should enter supplementary learning or higher-level tasks based on the evaluation results.

3.3. Teaching Organization: Implementing Differentiated Guidance,

Role Rotation, and Dynamic Advancement

Tiered teaching can be carried out according to "task introduction - learning diagnosis - tiered implementation - cross-review - feedback and advancement." Task introduction clarifies the work object, quality requirements, and safety standards; tiered implementation provides differentiated guidance; cross-review checks records, data, and conclusions according to technical specifications; feedback and advancement arranges supplementary training, similar consolidation, or higher-level tasks.

The guidance focus for the basic level is understanding the work process, using tools, and forming standardized records; the comprehensive level focuses on interpreting data and revising plans; the challenge level focuses on plan comparison and reflection. Teachers should gradually reduce step prompts to avoid students relying on standard answers and teacher demonstrations.

Group cooperation can set up roles such as resource lookup, testing operation, quality review, and delivery explanation, with regular rotation. Each student should keep personal work orders, operation records, and reflection notes, and when necessary, their actual participation should be confirmed through individual operations or oral defense.

3.4. Learning Evaluation: Establishing an Evaluation Mechanism Combining Common Baselines with Tiered Development

Tiered evaluation adopts "common indicators + tiered indicators." Common indicators include safe operations, operational standards, tool use, maintenance quality, and team collaboration, reflecting a unified professional baseline. The basic tier focuses on evaluating standardized testing, data recording, and basic conclusions; the comprehensive tier focuses on evaluating solution design, data interpretation, and hypothesis verification; the challenge tier focuses on evaluating path comparison, complex information processing, and optimization recommendations.

Evaluation evidence should cover both process and outcomes, including operation observation, diagnostic plans, testing records, maintenance work orders, and delivery explanations. Teacher evaluation ensures technical judgment and scoring standards, student self-evaluation promotes reflection, peer evaluation strengthens understanding of standards, and enterprise mentors may participate in evaluating task authenticity and job standards. Multi-party participation should clarify responsibilities and the scope of evidence, rather than simply increasing the number of scorers.

To ensure evaluation consistency, scoring rubrics and performance examples should be developed, along with scoring instructions and necessary reviews. Evaluation results are used both to judge task completion and to identify subsequent learning needs, avoiding the conversion of tiered evaluation into fixed student grades.

3.5. Feedback and Improvement: Forming a Teaching Closed Loop Based on Learning Evidence

Teachers should comprehensively analyze student work, operational performance, evaluation results, and learning reflections to determine whether problems originate from task difficulty, instructional scaffolding, equipment conditions, or guidance methods, and adjust teaching accordingly. The basic tier focuses on correcting standardized operation and basic diagnostic obstacles, the comprehensive tier strengthens the connection between solutions and evidence, and the challenge tier adds solution comparison and transfer reflection.

Feedback results are also used to adjust task tiers. Students who meet the requirements of the current tier may advance to a higher tier, while students who have not yet met the common baseline receive targeted supplementary learning, thereby forming a cycle of "implementation—evaluation—adjustment—reimplementation."

4. Key Conditions and Risk Prevention for Model Implementation

4.1. Strengthening the Pedagogical Transformation of Competition Resources

Before competition resources enter the curriculum, it should be reviewed whether they align with curriculum objectives, student foundations, practical training safety, and equipment conditions. Content that relies excessively on specialized equipment, exceeds curriculum capacity, or mainly serves competitive performance should not be directly adopted. Work processes, technical standards, and evaluation elements with universal teaching value should be retained, and teachability should be improved through task decomposition and scaffolding design [5-7].

4.2. Preventing student stratification and solidification

To prevent labeling and low expectations, stratification should be based on tasks and support rather than on student identity. Group labels with evaluative connotations should not be used publicly, and groups and task scopes should not be fixed long-term. At the same time, clear advancement conditions and learning pathways should be provided for students at the foundational level, so that stratification serves ability development.

4.3. Preventing group work from replacing individual learning

Group outcomes cannot directly represent each student's ability. In teaching, role rotation, individual work orders, random operations, individual defense, and peer verification should be used to confirm students' mastery of key steps. Evaluation should consider both the quality of group tasks and individual actual contributions.

4.4. Improving guarantees for faculty, equipment, and evaluation

Professional teachers, competition instructors, and enterprise technical personnel should conduct joint teaching research around task transformation and evaluation standards. Practical training conditions should prioritize basic norms and typical task teaching, and should not be premised on specific competition equipment; school-enterprise cooperation can support task verification and job evaluation. In addition, scoring training and necessary review should be used to improve evaluation consistency, and practical training safety should be a common requirement at all levels.

5. Conclusion

The stratified teaching of automotive maintenance courses in higher vocational education under the guidance of skills competitions is a collaborative process of transforming competition resources into teaching and promoting students' differentiated development. Based on the synergy of competition standards, job competencies, and course objectives, this paper constructs an operational model that connects learning situation diagnosis, a three-level task chain, dynamic teaching organization, performance-based evaluation, and feedback improvement. This model adheres to the unified bottom line of safety, standards, and quality, and responds to student differences through the progression of task comprehensiveness and diagnostic independence. Its task standards, evaluation rubrics, and organizational methods still need to be refined in conjunction with specific courses and practical training conditions, and continuously tested through real classroom evidence.

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