

Practical Exploration of Using Competency Maps to Promote the Achievement of Teaching Objectives

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Abstract

To address such problems in higher vocational specialized courses as vaguely stated teaching objectives, a disconnect between teaching implementation and those objectives, and the difficulty of verifying whether the objectives have been attained, this paper takes the course "Automobile Chassis Structure and Maintenance" as an example to explore a reform path that uses a competency map to promote the achievement of teaching objectives. Following the five-level mapping relationship of "post group – typical work item – work task – competency element – course module," a course competency map covering five teaching modules and twenty-one core work tasks was constructed. Through objective decomposition, task-driven instruction and process tracking, teaching and objectives were brought into close alignment; through observable evaluation criteria, multiple forms of process verification and a comprehensive assessment loop, the attainment of the objectives was examined; and a dynamic updating mechanism of "evaluation feedback – map iteration – objective optimization" was put in place. Practice shows that the competency map turns abstract course objectives into competency points that are observable, evaluable and traceable, drives teaching from a knowledge-based toward a competency-based orientation, and provides a replicable path for achieving the objectives of higher vocational specialized courses.

Keywords

Competency map; Achievement of teaching objectives; Automobile Chassis Structure and Maintenance; Teaching reform; Tigher vocational education

1. Introduction

Vocational education shoulders the important mission of cultivating high-quality technical and skilled talents, and whether course objectives can be achieved directly determines the quality of talent cultivation. In recent years, the state has made systematic arrangements for the teaching reform of vocational education. The Master Plan on Building a Strong Education Country (2024–2035) proposes

implementing a national education digitalization strategy and promoting artificial intelligence in support of educational transformation [1]. In February 2026, the Ministry of Education issued the Opinions on Deepening the Reform of the Key Elements of Vocational Education Teaching (Jiaozhicheng [2026] No. 1), which requires institutions to "align with the typical production tasks of leading enterprises, carry out occupational analysis and on-the-job mining, decompose and sort out the corresponding skill points and knowledge points, and draw course competency maps," thereby establishing the competency map as a foundational tool for advancing the comprehensive, modular and project-based development of courses [2]. Against the background of the accelerated digitalization of vocational education, course development is moving from the digitalization of resources toward system restructuring and model innovation [3], and the competency map has become an important lever in the reform of the key elements of teaching.

"Automobile Chassis Structure and Maintenance" is a core course for such specialties as automobile inspection and maintenance technology in higher vocational colleges. It covers chassis systems including the drivetrain, running gear, steering and braking systems, and extends to new-energy electric-drive chassis and intelligent drive-by-wire chassis. It is characterized by a large number of knowledge points, strong inter-system coupling and demanding practical requirements. In long-term teaching practice, the achievement of this course's objectives has faced three difficulties. First, the objectives are stated too vaguely: verbs such as "understand," "master" and "be familiar with" can hardly be translated into observable and measurable behavioral requirements. Second, teaching implementation is disconnected from the objectives: classroom work still centers on knowledge lecturing and single-skill drills and is not closely enough linked to real enterprise job tasks, so students easily end up "able to disassemble and assemble, but unable to diagnose" [4]. Third, the extent of achievement is hard to verify: assessment relies too heavily on the final written examination, making it difficult to judge whether professional competence has genuinely been formed.

The key to resolving these difficulties lies in providing course objectives with a carrier that can be "seen, traced and verified." To this end, the teaching team took the development of a competency map as its breakthrough point and carried out systematic reform around four questions: how objectives are to be decomposed, how teaching is to be implemented, how attainment is to be verified, and how the map is to be iterated.

2. Construction of the Competency Map for the "Automobile Chassis Structure and Maintenance" Course

2.1. Course positioning and job analysis

The course "Automobile Chassis Structure and Maintenance" is oriented to the automobile repair technician post. It is allocated 96 class hours and covers three

vehicle types: the conventional fuel-vehicle chassis, the new-energy electric-drive chassis and the intelligent drive-by-wire chassis. The course adheres to post-course alignment. Through expert interviews, on-the-job mining and questionnaire surveys, enterprise research was conducted; taking the complete chassis maintenance workflow of "pre-check – maintenance – diagnosis – quality inspection – delivery" as the main thread, five typical work items and twenty-one core work tasks were identified and used as the basic skeleton of the competency map.

2.2. Construction path based on five-level mapping

The course competency map is constructed in accordance with the five-level mapping relationship of "post group – typical work item – work task – competency element – course module," breaking away from the textbook's chapter system and realizing precise post-course correspondence. It is implemented in four steps. In the first step, the sources of competence are determined: the post-responsibility information obtained through enterprise research is used to clarify the core competency requirements of the chassis maintenance post. In the second step, competency elements are decomposed: the knowledge, ability and quality objectives set out in the course standard are broken down item by item into observable and evaluable competency indicators and aligned with national standards and vocational skill level standards — for example, "being able to complete chassis fault diagnosis" is decomposed into observable indicators such as "being able to collect fault information in accordance with operating procedures" and "being able to correctly locate the fault range." In the third step, module–task mapping is carried out to form a three-level progressive structure of "module – task – competency indicator," while each skill point is matched with corresponding knowledge points and quality points, ensuring that "competencies have granularity and courses provide support." In the fourth step, connection is made with assessment and evaluation: safety-operation competencies are subject to a one-vote veto, key operation competencies are benchmarked against the scoring criteria of skills competitions, and professional quality competencies are evaluated on site by enterprise mentors.

2.3. Content structure of the course competency map

Following the path described above, the course competency map takes shape as an overall structure of "five modules – twenty-one tasks – three-dimensional competency elements" (see Table 1).

Table 1. Module structure of the competency map for the "Automobile Chassis Structure and Maintenance" course

Module	Class Hours	No.of Tasks	Orientation of Competency Development
Module 1 Fundamentals of Automobile Chassis and Safety Regulations	8	2	Chassis familiarization, use of tools and equipment, safety protection, and completion of pre-check work orders
Module 2 Automobile Chassis Disassembly/Assembly and Mechanical Maintenance	28	4	Mechanical maintenance competence for the drivetrain, wheels, brakes, suspension and steering systems

Module 3 Diagnosis and Troubleshooting of Automobile Chassis Electronic Control Systems	28	7	Competence in diagnosing and calibrating electronic control systems such as EPB, ABS/ESP, steer-by-wire and brake-by-wire
Module 4 Comprehensive Diagnosis and Troubleshooting of Automobile Chassis Faults	24	3	Comprehensive fault diagnosis competence for fuel vehicles, new-energy vehicles and drive-by-wire chassis
Module 5 Quality Inspection and Delivery of Automobile Chassis Maintenance	8	5	Closed-loop competence in post-repair pre-check, static quality inspection, dynamic road test, archiving and preparation, and delivery

The five modules progress in the sequence of "basic familiarization – mechanical maintenance – electronic control diagnosis – comprehensive diagnosis – quality inspection and delivery," embodying a cultivation logic that runs from the single to the systematic and from conventional fuel vehicles to new-energy and drive-by-wire chassis. Each task is supported by three-dimensional elements, namely knowledge points, skill points and quality points. Taking the Module 1 task "Preparation for New-Energy Vehicle Chassis Maintenance and High-Voltage Safety Protection Operations" as an example, its competency elements are shown in Table 2.

Table 2. Examples of task competency elements (taking the task "Preparation for New-Energy Vehicle Chassis Maintenance and High-Voltage Safety Protection Operations" as an example)

Dimension	Examples of Competency Elements
Knowledge points	GB 18384—2025 Safety Requirements for Electric Vehicles; structure and operating principles of new-energy vehicles (battery electric/hybrid); principles of high-voltage circuits and safety regulations
Skill points	Able to complete the whole process of high-voltage power-on, power-off, voltage testing and discharging within 15 minutes with zero violations; able to use insulation testers, multimeters and other testing tools in a standardized way; able to carry out standardized emergency handling of high-voltage safety incidents
Quality points	Strictly observe high-voltage safety operating procedures; possess the ability to identify risks in high-voltage systems; master the emergency handling procedures for incidents such as high-voltage electric shock and short circuit

3. Implementation Path for Objective Achievement Based on the Competency Map

The value of a competency map lies in its use. The key to promoting objective achievement is to embed the map into the complete chain of objective decomposition, teaching implementation and process tracking.

3.1. Objective decomposition: from course objectives to competency points

The teaching team mapped the cultivation objectives set out in the course standard one by one onto the competency points of the twenty-one tasks, forming an objective chain of "course objective – module objective – task objective – competency point." In lesson preparation, teachers use the map to identify the competency points and supporting elements corresponding to each task. When a learning task is released, students turn to the map to understand "what competencies are to be achieved and according to what criteria they will be evaluated," so that the objectives are transformed from goals written in the teacher's lesson plan into a joint learning agreement between teacher and students, strengthening both their identification with the objectives and their intrinsic

motivation to learn.

3.2. Task-driven instruction: organizing teaching implementation around competency points

In the implementation stage, the course organizes teaching with typical work tasks as its carrier. For instance, the Module 3 task "Maintenance of the Brake Energy Recovery System of a New-Energy Vehicle" is carried forward along the process of "high-voltage power-off – reading VCU/BMS data streams – checking the brake switch and CAN bus signals – repair and testing – road test verification," and in completing the task students gradually develop competency points such as data stream analysis, signal troubleshooting and fault localization. For diagnosis tasks involving electronic control systems, diagnostic instruments, oscilloscopes and real fault cases are introduced, enabling students to construct their competencies in situations close to real job settings. Quality objectives are likewise realized through the map: the course makes the spirit of craftsmanship concrete as measurable operating criteria — for example, the torque of key bolts must be accurate to the manufacturer's tolerance, wheel dynamic unbalance must not exceed 5 grams, and the completeness rate of key quality-inspection items must reach 100% — and brings competencies involving safety red lines into the one-vote-veto assessment.

3.3. Process tracking: improving teaching with attainment data

Relying on the inventory of competency points established by the map, teachers continuously collect evidence during teaching — including task outputs (work orders, inspection records and diagnostic reports), records of hands-on observation, peer assessment and self-assessment — so as to build competency attainment records and keep track of every student's progress dynamically: competency points that have not been attained are dealt with through make-up tasks and targeted training, while those already attained are raised to higher requirements through extension tasks. Whenever the overall attainment rate of a given competency point is low, teachers promptly adjust the instructional design, add practice resources or re-examine the way the competency has been decomposed, thereby realizing data-driven precision teaching.

4. Verification and Evaluation of Objective Achievement Based on the Competency Map

Achieving an objective requires not only teaching accurately, but also evaluating substantively. Relying on the competency map, the teaching team has built a closed-loop verification system that combines process evaluation with outcome evaluation at three levels: criteria, process and result.

4.1. Establishing observable evaluation criteria for competency points

Observable evaluation criteria have been formulated for each competency point on the basis of the map, distinguishing three levels — pass, good and excellent. Instead of vague expressions such as "master ×× knowledge," the criteria describe behavioral performance that can actually be checked. For example, for the competency point "Recording the collection of fault information on chassis abnormal noise," the traditional formulation was "master the theoretical knowledge related to fault troubleshooting," whereas the map-oriented formulation reads: "able to complete the collection of fault information in accordance with operating procedures, correctly locate the fault range, record work orders completely and in a standardized manner, and operate safely without violations." The evaluation dimensions cover skill operation, knowledge application and professional quality, corresponding one-to-one with the three-dimensional elements of the map (see Table 3).

Table 3. Example of the evaluation rubric for a single competency point

Competency Point	Evaluation Dimension	Pass	Good	Excellent
Recording the collection of fault information on chassis abnormal noise	Skill operation	Able to collect basic fault symptoms	Able to collect all fault symptoms completely	Able to take the initiative to ask follow-up questions so as to supplement hidden fault information
Knowledge application	Able to distinguish fault categories in a simple way	Able to give a preliminary explanation of the symptoms by reference to principles	Able to lay out the logical chain through which the fault arises	Can sort out the logical chain of fault generation
Professional quality	Able to fill in the work order completely	Work order filled in to standard, without alterations	Rigorous in recording, and able to annotate risk warnings	Maintain rigorous records and label risk alerts

4.2. Conducting classroom process verification through multiple means

Competency attainment cannot wait to be tested until the end of the semester; it has to be put into practice in every single class. Teachers carry out process verification by drawing on task outputs, records of on-site observation of practical work, peer assessment and student self-assessment. Students check themselves against the map to see clearly which competency points have been attained and where their shortcomings lie; on that basis, teachers arrange make-up tasks and targeted training for the competency points not yet attained, enabling evaluation to genuinely perform its diagnostic and improvement functions.

4.3. Comprehensive assessment: closed-loop verification of overall competency achievement

At the end of a unit and at the end of the course, comprehensive tasks that approximate real enterprise scenarios are used for assessment; students complete an entire piece of work independently or in teams, and their overall comprehensive competence is verified against the map. The written examination has been reformed in parallel: questions based on pure rote memorization have been reduced, and case analysis and operating-condition judgment questions have been increased. Once the course is over, feedback from enterprise internships is collected to verify in reverse

whether the competency points fit the reality of the job, thus forming a closed loop of "map – teaching – evaluation – enterprise feedback – map updating."

5. Conclusion

The competency map provides higher vocational specialized courses with a visual tool covering the whole chain of "objective – teaching – evaluation – improvement." Taking the course "Automobile Chassis Structure and Maintenance" as an example, this paper constructed a course competency map covering five modules, twenty-one tasks and three-dimensional competency elements. Through the four links of objective decomposition, task-driven instruction, process tracking and evaluation verification, abstract course objectives were transformed into competency points that are observable, evaluable and traceable, thereby driving teaching from a knowledge-based toward a competency-based orientation and moving evaluation from experience-based judgment toward data-driven judgment. The next step will be to explore personalized learning-path recommendation and academic early warning on the basis of the map, and to continue optimizing the structure of the map and the objective system with the help of enterprise feedback.

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