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Explore the Craftsman Spirit in the Course Automobile Electronic Control Technology Under the Background of Engineering Education Professional Certification

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Abstract: Under the background of training-applied talents, the assessment methods of various professional courses are gradually in line with international standards. The process of engineering major training is to take craftsman spirit as the goal of talent training. This paper analyzes the matrix relationship between course objectives and assessment links under the background of engineering education professional certification, explores the connection between the setting of each course link between Automobile Electronic Control Technology and the basic content of craftsman spirit, and concretized the craftsman spirit in the course assessment setting so that the assessment objectives are directional.

Keywords: Professional certification of engineering education; Craftsman spirit; Automobile electronic control technology; Course link

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1. Introduction

Engineering Education Professional Certification aims to provide quality assurance of preparatory education for engineering talents to enter the industry. Since June 2016, China has become a contracting member of the international engineering education certification system "Washington Agreement." The majority of the universities have passed the engineering education professional certification, which indicates that China's engineering education has gradually become international standards, and getting international mutual recognition of engineering education and engineer qualifications while making unremitting efforts [1,2]. Automotive-related major, as one of the mainstream engineering majors, has a professional core course named "Automotive Electronic Control Technology" which laid a solid theoretical foundation and practical skills for the majority of engineering and technical talents, which is also closely related to the rapid development of electric vehicles today [3,4]. In this context, relying on the cultivation of a craftsman spirit can further cultivate

students' deep understanding of the value of the course and experience the connotation and value of the craftsman spirit [5,6].

2. Engineering education professional certification teaching framework

Engineering Education Professional Certification is a qualification evaluation oriented by achieving the teaching objectives and necessary graduation requirements. It can be concluded that student-centered, result-oriented and continuous improvement are the three basic concepts of engineering education certification [7]. In the process of each student's education, whether it is professional education or student work, it is the goal of students to achieve the final results, and constantly refine the educational content according to the educational results, improve the shortcomings, and revise the educational process and training goals for the enterprise needs [8].

According to the current mature teaching reform structure, the single-course teaching framework of engineering education certification is to take training objectives and graduation requirements as the punctuation point with the needs of enterprise talents [7–9]. It is done through teaching methods and other curriculum system content, combined with teaching resources to cultivate engineering and technical talents, and finally through a reasonable evaluation system to continuously improve the teaching process, as shown in **Figure 1**.

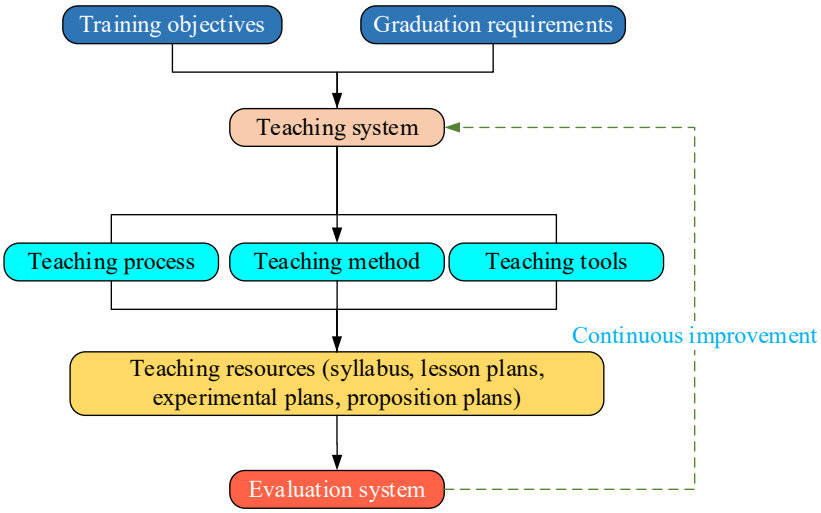

Figure 1. Teaching framework of engineering education certification.

3. Teaching system based on craftsman spirit

The craftsman spirit is the demand for industrial transformation, upgrading and manufacturing power while playing an important guiding role in training practical talents [10–13]. In the setting of the training objectives of the "Automobile Electronic Control Technology" course in colleges and universities, three corresponding degrees of high (H), medium (M) and low (L) are often used as the required indicators to support graduation [14], which are briefly described as follows:

(1) Master the basic engineering knowledge related to the course, and have the ability to apply it to solve problems.

(2) Based on scientific principles and methods such as physics and through literature search and analysis, formulate research routes and research programs for general or complex engineering problems in the field of automotive technology and automotive service.

(3) Have the ability to develop, select and use modern engineering technologies, methods and tools

required in the practice of automotive service engineering, to analyze and simulate general or more complex automotive service engineering problems.

The above three indicators support graduation requirements involving related engineering problems and tools, methods, and technologies (knowledge) to solve engineering problems. In the course implementation process, the three indicators need to correspond to the course content, the more basic knowledge, the more important content to master, and the more fundamental knowledge of the whole course. That is, the three indicators of H, M and L correspond to the three basic knowledge, case analysis and experiment of the course. According to the above analysis, combined with the basic content of the craftsman spirit, the contents of the three parts are sorted out as shown in **Figure 2**.

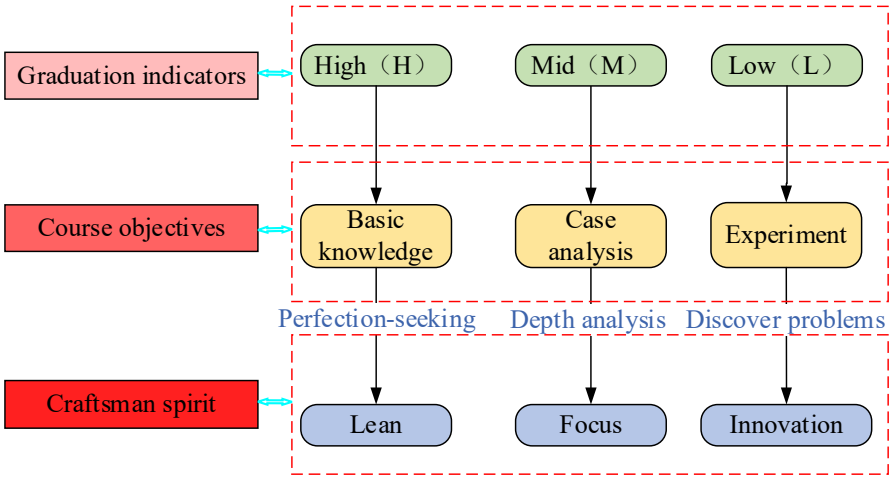

Figure 2. The relationship between graduation index, curriculum goal and craftsman spirit.

The basic content of the craftsman spirit includes four parts and the graduation requirements and course content of Automobile Electronic Control Technology are connected, forming a set of craftsman spirit-oriented teaching system:

(1) "Dedication" runs through the whole course, requiring students to study hard and cultivate themselves with respect.

(2) "Lean" emphasizes that students should not be based on the foundation, but concentrate on the strength, and pursue the better.

(3) "Focus" reminds students to apply what they learn, concentrate on nothing, and accumulate continuously.

(4) "Innovation" encourages students to be good at thinking and promotes innovation.

4. Course assessment

Automotive Electronic Control Technology is the core course of automotive-related majors, and its assessment form needs to be set based on the combination of process examination and Engineering Education Professional Certification [15]. Teachers complete classroom tasks through the process of theory teaching, animation display, case explanation, etc. At the same time, students can also acquire extracurricular knowledge, utilize network resources, such as college students' MOOCs and other ways to learn, and finally complete teaching tasks in the form of examinations. The assessment score of the course is the sum of the four parts of the final exam (50%), in-class exercises (10%), case analysis (20%) and experiment report (20%).

4.1. Matrix relationship between course objectives and assessment links

The assessment of the course will eventually be reflected in the score table of the students, so it is necessary to map the graduation goal of the course to the course goal and then divide the total score according to the importance of its indicators. The number of course objectives is limited, but the whole course assessment process needs to be rich and diversified. Therefore, when setting the assessment process, it is still necessary to correspond each course objective with the exercises and assessments, and the corresponding process needs to take into consideration the content involved in the course objective to be matched with the course objective in a relatively comprehensive way with a certain weight ratio. See **Table 1** for more details.

Table 1. Relationship between curriculum objectives and assessment links matrix

Course objectives	Assessment and grade ratio (%)				Total (%)
	In-class practice	Case studies	Lab report	Final exam	
1	8	2	5	30	45
2	2	13	5	15	35
3	-	5	10	5	20
Total (%)	10	20	20	50	100

4.2. Craftsman spirit in course assessment

According to the **Figure 2** and **Table 1**, it can be observed that the comprehensive ability of students is reflected by scores in the course assessment of Automotive Electronic Control Technology. It seems that all data in **Table 1** have nothing to do with the spirit of craftsmanship which is difficult to realize, but in fact, the spirit of craftsmanship can be concretized through quantity superposition, as shown in **Figure 3**. Compared with using the whole class as a sample to calculate the expectation to obtain the achievement degree of the course goal, using the concrete craftsman spirit to test the course goal and the relationship can show the rationality of the original intention of the settings and the teaching effect can be explained by simply passing or not and the grade distribution of the whole class. The problems and deficiencies in the teaching process should be analyzed by teachers according to the situation in the classroom and they should decide whether to adjust the relevant contents of the course assessment.

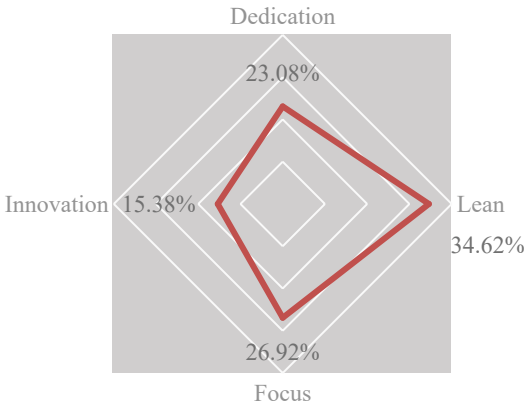

Figure 3. The proportion of craftsman spirit in the assessment of Automobile Electronic Control Technology.

According to **Figure 3**, it can be clearly concluded that under the background of professional certification of engineering education, Automotive Electronic Control Technology, as a core engineering course for

automotive related majors, is mainly concerned with the degree of students' "Lean" to the course, followed by the test of students' "Focus" and "Dedication", while "Innovation" is the guiding direction of learning. Therefore, the assessment setting of this course can be summarized as follows. The assessment of the basic contents of the four craftsman spirits is relatively balanced, and the focus set for the course attributes is prominent, and has a guiding role towards students.

5. Conclusion

The traditional teaching mode and the conventional curriculum teaching reform are often just a simple statement that a specific course has a certain connection with the craftsman spirit, but in fact, according to the Automobile Electronic Control Technology, it can be seen that the process of training-applied talents can take the four aspects of the craftsman spirit as training indicators. In the background of engineering education professional certification, whether it is the course content or the course assessment, the specific score can be corresponding to the four basic aspects of the craftsman spirit, so that the training goal of the course is more directional.

Disclosure statement

The authors declare no conflict of interest.

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