

## Refactoring analysis of Modular course system for electrical automation technology under the '1+X' certificate system

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**Abstract:** The promulgation of the '1 + X' certificate system has put forward new requirements for the cultivation of talents in vocational colleges, which will surely promote the reform of the content of employment-oriented vocational education courses and catalyze the restructuring of the curriculum system. The paper introduces the implementation background of the '1 + X' system and the status quo of the 'Course certificate' docking of electrical automation major in higher vocational colleges. Taking the "X" certificate for the installation of electric equipment in rail transit as an example, this paper analyzes the requirements of the assessment standards. Finally, the paper studies the reorganization plan of the modular curriculum system of the electrical automation specialty.

### 1. Introduction

According to the requirements of "implementing the dual certificate system of academic qualifications and professional qualifications" put forward by our country in 1993, the electrical automation technology major of our institute has implemented the 'double certificate' graduation system of academic certificates and electrician vocational qualifications for a long time. The practical exploration of the 'double certificate' system has played an important role in a relatively long period of time and has accumulated rich experience. In order to expand employment and entrepreneurship, the state has gradually reduced the scale of vocational qualification certificates, except for the access qualification certificates required by national laws and regulations for certain special industries, other vocational qualification certificates will be gradually transformed into horizontal certificates.

The National Vocational Education Reform Implementation Plan (Abbreviation 'Vocational Education 20') proposes that starting from 2019, the pilot work of the 'academic certificate + several vocational skill level certificates' system ('1 + X' certificate system) will be launched in vocational colleges and universities and applied undergraduate colleges and universities, which is an important deployment made by the Party Central Committee and the State Council for vocational education reform, and an important institutional design innovation for implementing the fundamental task of Lide Shuren, improving the vocational education and training system, and deepening the integration of industry-education school-enterprise cooperation<sup>[3]</sup>.

Since the promulgation of the '20 Articles of Vocational Education', the Department of Vocational Education and Adult Education of the Ministry of Education has successively issued four batches of vocational skill level certificate standards. The vocational skill level certificate for students in colleges and universities is an objective reflection of the vocational skill level of students in a certain vocational skill field, which is conducive to learners to better understand the tasks and ability requirements of vocational positions, and better carry out career selection and career planning. It is also conducive to the employer's understanding of the professional ability of job seekers and better allocation of resources.

### 2. Electrical automation technology professional certificate docking status

The promulgation of the '1 + X' certificate system has put forward new requirements for talent

training in vocational colleges, which will promote the reform of employment-oriented vocational education curriculum content and catalyze the reconstruction of curriculum system. The electrical automation technology specialty cultivates high-skilled talents for the era of 'Industry 4.0' and stands at the trend of the times. It must quickly seize the opportunity, optimize the curriculum, reform the curriculum content, and reconstruct the curriculum system of 'course certificate integration'. But for a long time, most colleges and universities are the implementation of electrical automation technology professional degree certificate and electrician ( maintenance electrician ) and other vocational qualification certificate ' double certificate ' graduation system. With the development of technology, some professional qualification certificates have been unable to keep up with the changes of enterprise technology, the number of professional qualification certificates has been reduced, and the standards of skill level certificates have been issued one after another. Electrical automation technology colleges and universities according to the region, relying on the industry background and employment-oriented, professional docking skills level certificate will be different. For example, in the announcement of the third batch of vocational education and training evaluation organization of the '1 + X' certificate system pilot, many skills assessment certificates such as rail transit electrical equipment installation and adjustment, industrial robot installation and adjustment, industrial robot integrated application, motion control system development and application are all oriented to electrical automation technology<sup>[4]</sup>. Colleges and universities must choose a reasonable 'X' skills certificate, in order to train in line with our automation professional employment-oriented compound technical and technical personnel services.

Hunan Railway Professional and Technology College has a profound background in the rail transit industry. It is deeply engaged in the whole industrial chain of rail transit equipment manufacturing. It focuses on transporting high-quality technical and skilled talents for the rail transit equipment manufacturing industry chain, and the full-time automation teachers of the college are deeply involved in the development of vocational skill level certificate standards for rail transit electrical equipment installation and adjustment. Rail transport electrical equipment adjustment skill level certificate, supplemented by other related skills certificate, the implementation of the '1 + X' certificate assessment system is the inevitable way of electrical automation technology professional construction and development.

However, although the electrical automation technology specialty of our college has experienced the reconstruction of the employment-oriented working process curriculum system, it only pays attention to the ability requirements of the single professional post of maintenance electrician. In the process of personnel training, some courses have been integrated into the electrical professional qualification assessment requirements, but there is still the status quo of parallel training of academic education and skill certification. Under such a traditional curriculum system, '1' and 'X' are difficult to effectively connect and integrate. In the tide of the implementation of the '1 + X' certificate, in order to effectively realize the integration of academic education and skill level assessment of automation specialty, it is necessary to fully analyze the content system of rail transit electrical equipment installation and adjustment skills assessment, understand the real needs of enterprises, organically integrate the requirements of post technical skills into the professional talent training program, integrate the teaching content of professional courses, break the original '1' and 'X' parallel system, and reconstruct the 'course certificate integration' curriculum system.

### **3. Interpretation of Skill Level Assessment Standard for Rail Transit Electrical Equipment**

Rail transit electrical equipment adjustment skills level standard is divided into primary, intermediate and senior. The docking ability and module division of each level assessment content are shown in Figure 1 <sup>[5]</sup>.

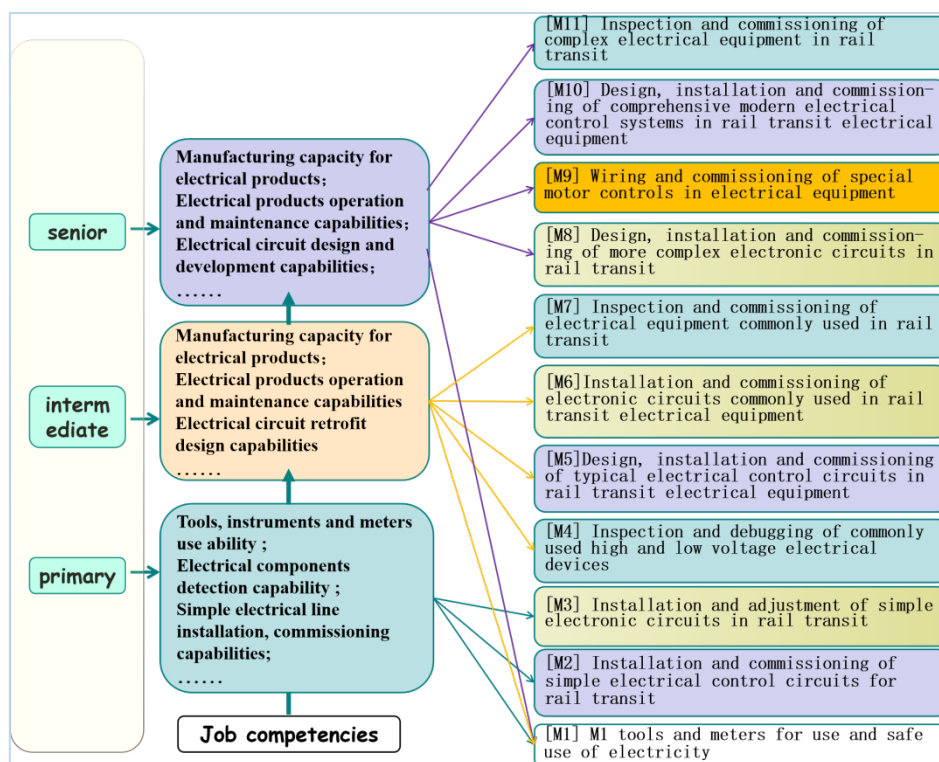


Figure 1 Skill Level Standard Capability and Module Requirements for Rail Transit Electrical Equipment

As can be seen from the figure, the primary, intermediate and senior skill level standard skill requirements gradually increased, the primary main requirements of tools and instruments using ability, electrical components detection and judgment ability, simple electrical, electronic circuit alignment ability. In addition to the primary basic capabilities, the intermediate level must be upgraded to the inspection and commissioning of commonly used electrical equipment, the ability to assemble and debug commonly used electronic and electrical lines, and simple design capabilities. senior is reflected in systematization, complexity and specialization. Obviously, the primary is the foundation, intermediate and senior in the knowledge and skills requirements gradually increased. For example, the assessment of electrical control circuit content in the primary only requires a simple circuit, in the middle is reflected in the common circuit, in the senior is rising to a comprehensive modern electrical control system. In terms of ability, it reflects the change from adjustment to design.

#### 4. Reconstruction Design of Electrical Automation Technology Course System

The 'X' skill level standard is developed by third-party vocational education and training evaluation organizations such as enterprise industries, and is a professional skill level standard for the construction of socialized mechanisms. Vocational colleges are the supply side of talents. An important measure to improve the quality of talent training is to integrate the 'X' skill assessment content into the talent training program, so as to improve the fit between talent training and industrial demand, cultivate compound technical and skilled talents, and expand students' employment and entrepreneurship skills.

From the rail transit electrical equipment alignment skill level assessment content, modular curriculum is the best way to 'course certificate integration'. However, the original curriculum system framework of electrical automation technology is a progressive structure of public basic course-professional basic course-professional core course-expansion course. The connection between courses is mainly the former follow-up relationship. Students can not systematically understand the status and role of the course when learning, and do not know why to learn. Many teachers also only know the content and skill requirements of the course, and have a certain

understanding of the application, but the role in the whole professional curriculum system is not clear, not to mention the role of the content of the course in the X skill level certification, and the docking of curriculum knowledge and skills and positions is not clear. 'Course-Certificate Integration' reconstructs the curriculum system, it is necessary to directly connect the course content with the rail transit electrical equipment installation, adjustment and assessment module of the primary, secondary and senior design modular courses. At the same time, the courses corresponding to other certificates are selected as elective courses for students to achieve the purpose of compound training and personalized training.

Figure 2 is the correspondence between the course and the assessment module. It can be seen from the figure that some courses such as electrical foundation and electrical training, PLC technology and application, industrial control system training and assessment module are one-to-one correspondence, but some courses such as motor and electrical control technology are multiple correspondences, that is, a course corresponds to the assessment content of multiple levels and modules. In the course system design, the course content corresponding to the primary module can be directly designed as the professional basic course module, and only the senior module course can be set as the professional core course module or the extended course module. According to the degree of difficulty, the three modules of primary, intermediate and senior are designed, which correspond to the three levels of skill assessment standards. For example, the motor and electrical control technology and electrical control training, machine tool training are decomposed and then reorganized into three modules of motor and electrical control technology, junior, middle and senior. The course content is from shallow to deep, showing the form of 'spiral rise'. The primary modules are arranged in the professional basic course part and completed in the freshman year; the intermediate and senior levels are distributed in the professional core courses and extended courses, which are completed in the sophomore and junior stages. When students learn through professional basic courses, they also reach the primary module skill level of X certificate assessment standard. When they learn through professional core courses, they indicate that they have reached the intermediate module skill level of X certificate assessment standard. As a result, some professional courses examination and vocational skill level assessment can be arranged to achieve 'certificate integration' evaluation system.

## 5. Implementation of Modular Curriculum System Reform

After the reconstruction of the modular curriculum system, in order to ensure the implementation effect, it is necessary to simultaneously build the corresponding teaching staff, modular training resources, assessment and training system, etc, among which the requirements for teachers are particularly important.

As we all know, a small number of our teachers have had a lesson for 10 years. There is no pressure on teachers' teaching and their professional ability is not improved. After the reorganization of the curriculum, the same course is divided into primary, intermediate and senior, and there are difficulties. If teachers want to adapt to the systematic teaching needs of the curriculum, the structure of teachers' personal knowledge and ability must also be reorganized, and the knowledge field must be continuously broadened to form compound technical ability. This forces teachers who used to take only one course to learn actively, systematically, and have the ability to teach at least one modular course of their major. Teachers can participate in the teacher training of rail transit skill level, master the content of X skill level assessment standard, assessment requirements and methods, and implement teaching according to the standard. At the same time, teachers can choose enterprises and positions purposefully when participating in enterprise practice or temporary exercise, connect assessment standards, and connect new trends and new technologies in the industry, so as to improve professional and technical skills in the field of rail transit.

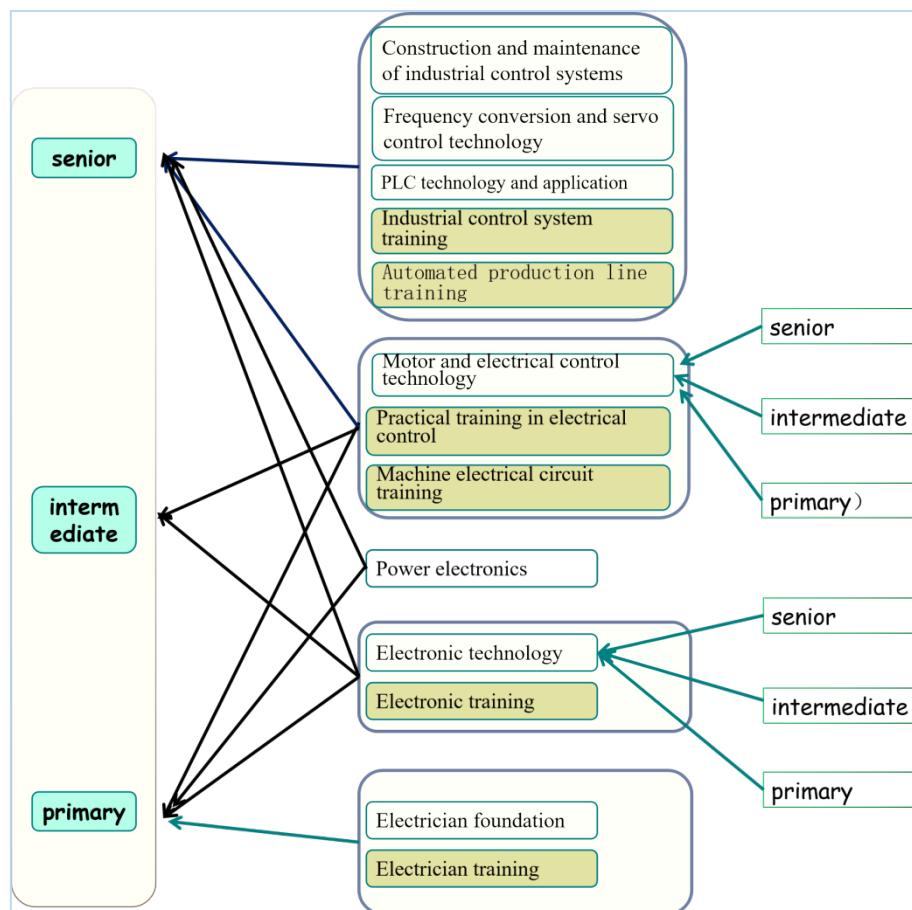


Figure 2 Modular curriculum reform design

## 6. Conclusion

As a type of education, vocational education has important characteristics and key advantages in closely linking industries, and the '1+X' certificate system is an important system design for improving the vocational education and training system, deepening school-enterprise cooperation, and integrating industry and education. Reorganizing the course content, reconstructing the course system, and organically integrating the 'X' skill level assessment content into the professional talent training program are the core of realizing the 'course certificate integration'. This paper analyzes the modular course reorganization scheme of higher vocational electrical automation technology major docking rail transit electrical equipment installation and adjustment occupational skill level standards, which has a certain reference effect on the reconstruction of the curriculum system under the '1+X' certificate system. However, it is necessary to truly implement the equal emphasis on academic education and training, so that academic education and vocational training can be combined, and there are still many supporting construction contents to achieve 'curriculum and certificate integration', such as building a double-quality teaching staff, coordinating teaching organization and teaching implementation, deepening the reform of teaching methods and methods, and compiling new loose-leaf and work manual-style teaching materials.

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