

# Research on the Cultivation and Reserve Construction of Contestants for Vocational Skills Competitions in Higher Vocational Colleges: Taking Electrical Automation Major as an Example

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**Abstract:** This paper takes the selection of students majoring in electrical automation to participate in professional-related skills competitions under the educational background of higher vocational colleges as an example. It explores the selection and cultivation of contestants under the current educational model and competition standards of skills competitions, as well as the long-term reserve of backup contestants and the construction of talent echelon. By elucidating the significance of vocational skills competitions, this paper analyzes the status of cultivating contestants for electrical automation majors in vocational skills competitions, and proposes relevant solutions to problems such as weak professional foundations, imperfect training systems, inadequate guidance time and lack of connection between professional teaching and skill competitions. In terms of combining professional skills and education, four solutions have been proposed: optimizing curriculum design, hardware-based specialized training, software-based specialized training, and simulation-based teaching. This study provides relevant references for the selection and training of contestants for instructors in electrical automation majors, and helps contestants to better train before the competition begins.

**Keywords:** Higher Vocational Colleges; Electrical Automation; Vocational Skills Competitions; Contestant Cultivation

## 1. Introduction

As an important event to enhance the professional skills of students in vocational colleges, the Vocational Skills Competition aims to stimulate students' enthusiasm for learning and consolidate their professional technical

skills through the form of competition. Vocational skills competitions have a significant positive impact on the quality of talent cultivation<sup>[1]</sup>. The skills competition in vocational colleges represents a new development approach in vocational education aimed at cultivating high-quality technical and skilled talents<sup>[2]</sup>. It also strives to fully demonstrate the achievements of the reform and development of vocational education and promote the integration of production and education between vocational colleges and industries<sup>[3]</sup>. Given its characteristics of strong professionalism, fierce competition, skill promotion, and talent cultivation, the Vocational Skills Competition has a strong influence on talent cultivation in higher vocational colleges. As an important competition to test students' technical skills, the National Vocational Skills Competition also provides assistance for higher vocational colleges in cultivating students' craftsmanship spirit<sup>[4]</sup>. In recent years, all higher vocational colleges have been continuously exploring how to make their talent cultivation more in line with the actual needs of the Vocational Skills Competition, in order to cultivate more skilled students to participate in the competition.

## 2. Analysis of the Current Status of Competitor Cultivation in the Vocational Skills Competition for Electrical Automation Majors

Taking the electrical automation major as an example, there are numerous professional-related competition items involved in the Vocational Skills Competition. Some of the more representative ones include: electrical equipment bus control, industrial robot

control, industrial network control, sensor application technology, etc. In terms of competition item selection, students majoring in electrical automation have a very wide range of options. The professional techniques involved in these competition items all require a foundation in electrical engineering-related courses. Only when students have a solid foundation in professional courses can they be more proactive in selecting competition items. Based on this wide range of options, how to achieve good results in the Vocational Skills Competition is the main research focus of vocational colleges. In the Vocational Skills Competition for electrical automation majors in vocational colleges, the current main issues include:

(1) Weak professional foundation<sup>[5]</sup>. In recent years, the enrollment of vocational colleges has tended to follow a trend of increasing proportions of students being recruited through categorized enrollment. In terms of major selection, a large proportion of students have focused on liberal arts courses during their junior and senior high school years, but later enroll in engineering majors in vocational colleges. These students share the common characteristics of lacking a systematic foundation in basic courses such as mathematics and physics, which are essential for engineering majors. After entering their majors, they struggle to form a complete and systematic thinking logic in science and engineering. Their progress in learning professional foundation courses is often slow, and their level of comprehension is not ideal.

(2) Low enthusiasm for participation. Due to the characteristics of the Vocational Skills Competition, the prior to the match preparation period is relatively long. For contestants, compared to students who do not participate, they need to devote more after-school time to the preliminary preparation for the competition. During the preparation period, contestants must not only ensure the quality and quantity of prior to the match training but also actively participate in the normal teaching activities of the school. This requires a great deal of time and effort from the contestants. Consequently, a considerable number of students are reluctant to participate in the Vocational Skills Competition, and their enthusiasm for participation gradually decreases.

(3) Imperfect training system. Some vocational colleges adopt a teaching model of two years of on-campus instruction followed by one year of

off-campus internship. This leads to the fact that both instructors and contestants participating in the Vocational Skills Competition cannot use a year-long period for targeted training and cultivation. The duration during which students can participate in vocational skills competitions while on campus is significantly shortened. Instructors also do not have enough time to conduct systematic, professional, and targeted training for contestants within a short period. The imperfect training system will not only result in unsatisfactory competition results but will also feedback negatively, further reducing contestants' enthusiasm for participation.

(4) Insufficient reserve of promising contestants. Vocational colleges usually send at least one core team for each competition. However, in recent years, some vocational colleges have frequently encountered the issue of insufficient reserve of promising contestants. They only prepare teams specifically for the current competition, but fail to cultivate a solid pool of backup contestants, leading to a gap in the overall participation teams. A good tradition of "Experienced players guiding newcomers" within the team is not established, where experienced contestants guide newcomers. Some contestants who perform well in the competition quickly end their participation after one competition, requiring subsequent contestants to start their training from scratch again.

(5) Unbalanced reward and punishment mechanism. Participating in the Vocational Skills Competition plays an irreplaceable role in contestants' mastery of professional knowledge. However, merely mastering professional knowledge is not enough to stimulate contestants' enthusiasm for learning and competition, and translate it into effective competition results. During the guidance and teaching process, it has been observed that most students are more interested in the reward mechanism of the competition. The prize money for participating is often a motivation for some contestants. If a more substantial reward mechanism can be established, it will undoubtedly provide a significant incentive for contestants.

(6) Insufficient guidance time. In vocational

colleges, professional teachers not only undertake a considerable portion of teaching tasks but also need to guide students in preparing for the Vocational Skills Competition after class. Most instructors hold multiple positions, serving as both professional teachers and administrative staff, responsible for teaching, managing student affairs, and other tasks. As a result, they often do not have sufficient energy to devote to guiding contestants in preparing for the competition. Additionally, the competition equipment used in the Vocational Skills Competition is at the forefront of the industry, and most instructors often fail to access the latest equipment and technologies in a timely manner, leading to a lack of professional skills and qualifications to guide contestants effectively.

(7) Insufficient integration between professional teaching and skills competitions. It has been observed in teaching that there is a lack of good integration between the professional qualities required by the Vocational Skills Competition and the professional education offered by vocational colleges<sup>[6]</sup>. Taking the "Industrial Network Control" competition in the electrical automation major as an example, contestants are required to operate and control the overall system while also completing network configuration and cable preparation. They also need to be familiar with digital twin technology, achieving both virtual-virtual and virtual-real integration. This requires contestants to not only proficiently master course knowledge but also have a good understanding of the cutting-edge knowledge and development directions of the electrical automation major. The competition process also serves as a test and training ground for students' adaptability and innovation abilities. Such competition standards require contestants to possess not only solid professional fundamentals but also extensive extended knowledge. The teaching of the electrical automation major should incorporate more integration between theory and practice. Currently, teaching in vocational colleges still focuses primarily on classroom and theoretical knowledge, without deeper integration of content related to the Electrical Automation Competition into classroom instruction.

### **3. Methods for Cultivating Contestants for Electrical Automation Professional Skills Competitions**

In response to the current situation of Electrical Automation Professional Skills Competitions held by vocational colleges, and the issues existing in contestant cultivation, combined with the experience of instructors from previous years, this study proposes the following aspects for researching cultivation programs:

(1) Strengthen professional fundamentals. In response to the inadequate professional fundamentals of contestants in the Electrical Automation major, vocational colleges should specifically strengthen these foundations. Projects with strong professionalism, such as circuit inspection and maintenance, analog circuit construction, digital circuit simulation, and the use of programmable logic control, have high requirements for electrical knowledge. Contestants may not have sufficient related knowledge during their junior and senior high school years. To provide contestants with corresponding knowledge reserves and more comprehensive preliminary knowledge for subsequent training, relevant professional interest classes, high-quality online course broadcasts, and introductions to specialized courses can be offered.

(2) Encourage participation with craftsmanship spirit. During the teaching of basic professional courses, professional teachers should introduce the study of craftsmanship spirit in a timely manner. The craftsmanship spirit encompasses not only professional qualities and ethics but also profound connotations at multiple levels such as work attitude and striving for excellence. The electrical automation major should develop specific and feasible craftsman spirit cultivation goals based on its own characteristics and skill needs. These goals should cover theoretical knowledge, practical operation and professional quality to ensure that students can be comprehensively and systematically trained during their school years<sup>[7]</sup>. The preliminary preparation for the competition undoubtedly requires a lot of time and energy, and introducing the craftsmanship spirit can enhance contestants' enthusiasm for participation. At the same time, it can cultivate contestants' perseverance and spirit of struggle, as well as their strong thirst for knowledge. This allows contestants to have

strong willpower while increasing their enthusiasm for participation.

(3) Establish a Scientific Training System. The professional courses in the Electrical Automation major cover most of the knowledge related to electricity and also include a vast amount of knowledge related to control technology. Given the differences in competition projects and the limited time students have for study in school, a scientific training system must be established to enable contestants to achieve better results in vocational skills competitions. Taking the "Industrial Network Control Technology" competition as an example, this competition requires contestants to have solid control knowledge and be able to program Siemens system programmable controllers. In the training system, emphasis should be placed on cultivating contestants' knowledge related to control technology and conducting extensive relevant training. The initial preparation phase involves theoretical learning of programmable controllers, while the practical training phase needs to be consistent with the competition. Corresponding exercises with Siemens series programmable logic controllers can better prepare contestants for the competition.

(4) Strengthen the Reserve of Seed Contestants. The reserve of seed contestants requires, to a certain extent, the previous contestants to motivate and guide the subsequent reserve contestants. It is better to teach someone how to fish than to give them a fish. With the help of instructors, the previous contestants should gradually guide the backup contestants and discover potential seed contestants in the process of guidance. Taking the Electrical Automation major as an example, welding circuit boards is a practical skill required in both competitions and future professional studies. After completing the basic professional courses, the reserve contestants can be instructed by the previous contestants on the relevant welding precautions and then proceed with related welding practices. In the process of practice, the professional skills of seed contestants are gradually cultivated, realizing a professional echelon construction.

(5) A Comprehensive Reward System. Currently, most institutions do not have a corresponding reward system for participating in vocational skills competitions. Competitions inherently involve winners and losers, as well as rankings. For contestants, the lack of recognition and corresponding rewards for a competition that has

consumed a significant amount of their time and effort can greatly dampen their enthusiasm. Vocational colleges can explore new methods for rewarding participants in vocational skills competitions. Teams that do not achieve rankings should also be rewarded in some way. For instance, issuing relevant honor certificates can positively motivate contestants' enthusiasm for participating.

(6) Sufficient Time for Teamwork and Guidance. Establish a corresponding team of instructors for each project, leveraging the strengths of the team to address individual time constraints. The time of team members can be complementary, and through reasonable arrangements, the overall preparation and guidance for the competition can achieve better results. While the instructor team divides tasks and cooperates, it is also essential to communicate and exchange ideas promptly. Continuous learning of new technologies and standards ensures further improvement in the quality of guidance.

#### **4. Integration of Technical Requirements and Professional Education in Electrical Automation**

Addressing the common issue of insufficient connection between professional teaching and skills competitions in vocational skills contests, and integrating the teaching characteristics of the Electrical Automation major with the skill requirements of the Electrical Automation professional vocational competitions, the following methods can be employed to better achieve a deep integration of professional education and skill requirements:

(1) Optimize Curriculum Design. Optimizing curriculum design is a crucial step in enhancing the quality of electrical automation talent cultivation in vocational colleges<sup>[8]</sup>. Institutions should conduct in-depth research on course content in conjunction with industry requirements to ensure their alignment. Electrical automation is a highly practical discipline, with specialized courses such as Analog Electronics and Digital Electronics requiring strong hands-on skills. Schools can continuously improve students' practical abilities by setting up analog electronics

training rooms and digital electronics enterprise practices. Additionally, interdisciplinary comprehensive curriculum design is an essential aspect of optimized curriculum design. By offering interdisciplinary integrated courses, institutions can cultivate all-round talents. For instance, by combining courses like Industrial Robot Control Technology and Modern Control Theory, comprehensive projects can be provided to cultivate students' abilities in solving complex problems.

(2) Specialized Training in Hardware Setup. As a crucial hardware platform closely related to the Electrical Automation major, hardware setup is an indispensable component, both in the context of competition requirements for vocational skills contests and in terms of the skills demanded by enterprises. Professional teachers should try to apply modern and scientific teaching methods in the hardware teaching process, so as to stimulate students' enthusiasm for participating in classroom learning<sup>[9]</sup>. Institutions can integrate the characteristics of courses to cultivate students' specialized training in hardware setup. For instance, relying on teaching equipment such as servo motors, students can be guided to complete the setup of motor control circuits. This specialized training in hardware setup can profoundly exercise students' practical abilities, enabling them to tackle various hardware setup requirements that may arise during competitions.

(3) Software Programming, Testing, and Regulation. Taking the "Industrial Network Control Technology" project, a vocational skills competition event related to the Electrical Automation major, as an example, competitors are required to complete software programming within a certain time frame, enable download on the host computer, and be able to control the movements of robotic arms through software programming. Schools should provide students with a real programming environment during the process of professional education, so that they can learn programming techniques more deeply and master programming languages more proficiently, thereby enhancing their programming abilities<sup>[10]</sup>.

(4) Simulation Training and Teaching. Based on the vocational skills competitions in the Electrical Automation major, relevant simulation training and teaching should be conducted. This includes workstation layout, identical competition equipment, fault settings, and simulation of the competition environment.

These activities aim to exercise students' psychological resilience and their ability to handle unexpected situations. After the simulation training, timely review and summary should be conducted to enhance contestants' ability to respond promptly on the spot.

## 5. Conclusion

As a major that has gained increasing popularity in recent years, the professional vocational skills competitions related to Electrical Automation Technology have also become more intense annually. The growing number of participating institutions and the increasing difficulty of competition setups have both posed challenges to achieving good results in the competitions. Traditional training models for competitions are no longer effective in achieving good outcomes in current competition processes. A three-pronged approach of targeted selection of contestants, scientific and systematic prior to the match training, and training for backup contestants is necessary to achieve effectiveness in related competitions of the Electrical Automation major. This article, by combining the teaching background of vocational colleges, the characteristics of the Electrical Automation major, and the professional requirements of vocational skills competitions, proposes corresponding solutions to the issues encountered by Electrical Automation majors in competitions. In practical implementation, these solutions can better stimulate students' interest in learning skills and cultivate more outstanding Electrical Automation professionals for the country.

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