Education Reform and Development, 2024, Volume 6, Issue 8
https://ojs.bbwpublisher.com/index.php/ERD
Online ISSN: 2652-5372
Print ISSN: 2652-5364

Teaching Reform and Practice of PLC Course with the Integration of Job Certification Competition Courses

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Abstract: This article aims to explore the teaching reform and practice of PLC courses under the integration mode of job certification and competition courses. By analyzing the current problems in the teaching of PLC courses in vocational schools and combining elements such as job requirements, skill certificate certification and skill competitions, a series of reform measures and practical experience have been proposed. The results indicate that the teaching mode of integrating job certification and competition courses can effectively enhance students' practical abilities and professional qualities, providing new ideas and methods for teaching PLC courses in vocational schools.

Keywords: Integration of job certification competitions and courses; PLC course; Reform in education

Online publication: August 22, 2024

1. Introduction

With the rapid development of industrial automation, the importance of programmable logic controllers (PLCs) as the core equipment of industrial automation control is increasingly prominent [1]. As an important way to cultivate skilled talents, the teaching quality of PLC courses in vocational schools is directly related to the career development of students and the employment needs of enterprises. However, the traditional teaching mode of PLC courses often has problems, such as a disconnect between theory and practice, and course content lagging behind job requirements. Therefore, exploring the teaching mode of integrating job certification and competition courses is of great significance for improving the teaching quality of PLC courses and cultivating high-quality skilled talents that meet the needs of enterprises [2].

The teaching model of integrating job requirements, course learning, skill competitions and vocational qualification certification is an innovative teaching concept advocated in the field of vocational education in China in recent years. It emphasizes the organic integration of job requirements, course learning, skill competitions and vocational qualification certification to improve comprehensively the teaching quality of vocational education [3]. According to the strategic plan of the national education department, vocational

colleges should actively promote the construction of a comprehensive education system that integrates job courses, competitions and certifications. The proposal of this teaching model not only meets the expectations and requirements of the country for vocational skill training but also greatly promotes the reform of vocational education, pointing out the direction and goals for the development of vocational colleges.

2. Significance of integrating job courses, competitions and certifications for vocational mechanical and electrical majors

2.1. Promote the comprehensive implementation of the "1+X" certificate system

At present, the "1+X" certificate system has been deeply applied in vocational mechanical and electrical education. Students master basic course knowledge and need to participate in vocational examinations and obtain corresponding qualification certificates [4]. Under the teaching system of integrating on-the-job courses, competitions and certifications, this certification system has been effectively implemented and guaranteed. This profoundly impacts students' professional literacy, promoting deep integration of industry and education, enhancing employment competitiveness and promoting vocational education reform. Under this advanced teaching model, professional standards, practical operational skills and theoretical knowledge have been comprehensively integrated. Through systematic learning, students can gain a deeper understanding of the work environment and career requirements, thereby effectively enhancing their professional competence. In addition, this teaching model fully integrates resources from all sectors of society, achieving the goal of integrating industry and education and laying a solid foundation for cultivating outstanding talents with practical experience and innovative abilities [5].

Through the "1+X" certificate system, students can not only obtain vocational qualification certificates, but also accumulate practical experience in the learning process, enhance their employment competitiveness and improve their employment prospects [6]. This teaching model plays a crucial role in the reform of vocational education, as it helps to promote the informatization, intelligence and modernization of traditional vocational education, injecting new vitality into the sustainable development and progress of vocational education.

2.2. Promoting the integration and diversification of education

The integrated teaching model of "job, course and certificate" provides clear guidance for the development of vocational education, especially the vocational education system supported by high-level projects such as school reform, group management and integration of industry, academia and research [7]. Meanwhile, effective integration of courses has opened up new avenues and methods for evaluating vocational education curriculum teaching. Nowadays, vocational education has surpassed the scope of traditional hierarchical education and has become a unique type of education. In this context, implementing an integrated teaching model of "job, class, competition, and certification" not only promotes the in-depth development of integrated and diversified education but also helps to integrate different learning methods and certification acquisition channels, enabling students to absorb knowledge more efficiently [8].

In the teaching process, this model can build a close bridge between theory and practice, stimulate students' motivation for continuous practice through qualification certification, skill competitions and practical work, deepen their experience accumulation and technical mastery, thus have stronger abilities in innovation and practice [9]. In addition, this teaching model endows students with greater learning choices, whether learning methods or content, which can be independently decided by students. This not only exercises their self-development and self-learning abilities but also enables them to make more significant progress in a diverse learning environment [10].

2.3. Promoting the implementation of the reform of the "Three Teachings"

The "Three Education" reform includes three levels: teachers, teaching and textbooks. The "Three Education" reform, namely the reform of teachers, teaching, and textbooks, has been deeply implemented under the integrated teaching model of "On-the-job course competition certification" [11]. Implementing this teaching model has put forward higher requirements for the roles and responsibilities of teachers, promoting their development towards a "dual teacher" direction. Teachers not only need to improve continuously their practical abilities but also need to deepen their practical experience in enterprises and enhance their professional competence. At the same time, teachers need to actively integrate curriculum resources, promote curriculum reform and play an important role in teaching reform, providing students with more accurate and effective guidance. In addition, teachers must enhance their management and organizational abilities, maintain a keen insight into various competition information, guide students to conduct targeted training and ensure that students can fully demonstrate their abilities in competitions.

At the teaching level, the reconstruction of professional practical courses has become the focus of reform. Compared with conventional teaching methods, the "On-the-job course certification competition" integrated teaching mode integrates vocational skill level certificates and vocational skill competitions based on the original school enterprise learning mode, making teaching more in line with the actual needs of the industry [12]. Therefore, it is particularly important to build a comprehensive teaching system with competition certificates as the core, covering evaluation objects, connotations and characteristics, which helps to make up for the shortcomings of traditional integrated teaching.

At the textbook level, as the main carrier of teaching content and the foundation for teacher and student learning, corresponding reforms are also needed. The new textbooks should be closer to industry reality, highlight competition characteristics and fully consider the talent needs of enterprises, reflecting the trend of technological development and innovation. In textbook construction, it is necessary to integrate competition assessment content and conduct comprehensive quality evaluations to cultivate students' competitive awareness and comprehensive strength. At the same time, it is also necessary to ensure the quality of teaching materials, enhance the sense of innovation, do a good job in evaluating teaching materials, ensure the progressiveness, practical, normative and scientific content of teaching materials, and meet the needs of PLC curriculum reform of electromechanical specialty in secondary vocational schools [13].

3. Problems in current PLC course teaching

3.1. Serious disconnection between theory and practice

The disconnection between theory and practice is a common problem in teaching PLC courses in vocational schools. Many vocational schools often separate theoretical and practical courses in the PLC curriculum, making it difficult for students to combine the theoretical knowledge they have learned with practical operations. This disconnected teaching mode not only reduces students' interest in learning but also affects their in-depth understanding and mastery of PLC technology.

3.2. The textbook content is outdated and does not match the job requirements

With the rapid development of industrial technology, PLC technology is also constantly being updated and replaced. However, some PLC course textbooks in vocational schools remain in older versions, with outdated content that cannot keep up with the latest technological developments [14]. This leads to a significant gap between the knowledge learned by students and the actual job requirements, making it difficult to meet the employment needs of enterprises.

3.3. Weak teaching staff and lack of practical experience

Teachers of PLC courses in vocational schools often lack practical engineering experience, resulting in the inability to combine theoretical knowledge with practical applications in the teaching process. In addition, some teachers' professional competence and teaching ability also need to be improved, making it difficult to guide students effectively in practical operations and problem-solving.

3.4. Single teaching methods and lack of innovation

At present, many vocational schools still use traditional teaching methods for PLC courses, such as lecture-based and demonstration-based teaching. Although these methods have advantages, they often lack interactivity and innovation, making it difficult to stimulate students' interest and enthusiasm in learning. At the same time, students' practical operational and innovative abilities are also not cultivated.

3.5. Incomplete evaluation system and lack of effectiveness

The evaluation system of PLC courses in vocational schools often focuses too much on assessing theoretical knowledge while neglecting the evaluation of students' practical abilities and professional qualities. This evaluation method cannot fully reflect students' comprehensive ability and actual level, and it is also difficult to connect with enterprises' employment needs.

There are problems in teaching PLC courses in vocational schools, such as a disconnect between theory and practice, outdated textbook content, weak teaching staff, single teaching methods, and incomplete evaluation systems. To improve the teaching quality of PLC courses and cultivate high-quality skilled talents that meet the needs of enterprises, it is necessary to carry out in-depth reforms and practices to address these issues.

4. Teaching reform measures for the integration of job certification competitions and courses

4.1. Optimize the course structure and achieve a combination of theory and practice

When constructing practical teaching, taking the training mode of industry competitions as a reference continuously enriches and improves the existing practical teaching system. At the same time, it is necessary to ensure effective integration of vocational education, curriculum integration, demand integration, industry implementation, evaluation integration and standard integration, forming a synergistic effect. Schools and enterprises should strengthen their connections, jointly transform teaching content and combine curriculum standards, competition requirements and industry standards to reorganize the internal connections between courses and positions, vocational skills competitions and certificates, thereby promoting improving students' skill levels [15].

By redesigning the course structure, theoretical teaching is closely integrated with practical operations. For example, in theoretical teaching, experimental sections are interspersed to allow students to master theoretical knowledge while carrying out practical operations. At the same time, specialized training courses will be offered to enable students to engage in practical operations, such as PLC programming and debugging in simulated actual work environments.

4.2. Update course content and align with job requirements

The core guiding principles in talent cultivation in vocational colleges cannot be separated from the needs of the job market, the standards of enterprise employment and the norms of industry technology. The education

chain of local vocational colleges is often closely connected to the regional economy's employment chain and industrial links, reflecting each other. Therefore, closer cooperation and communication channels should be established between enterprises and vocational colleges to ensure that the talents cultivated can accurately meet the actual needs of the enterprise.

Update course content in a timely manner based on the latest requirements of enterprises for PLC technology. Introduce the latest PLC equipment and technology to enable students to understand and master the latest technological trends. At the same time, strengthen cooperation and communication with enterprises, invite enterprise experts to participate in course design and teaching, and ensure that the course content is closely aligned with job requirements.

Guided by the "On-the-job course certification competition" concept, the teaching content is comprehensively reconstructed. In the project-based teaching content of PLC, tasks should be approached from shallow to deep, in accordance with students' cognitive laws. The project content should cover typical technical and equipment information that students may encounter in their work to ensure the practicality and pertinence of learning.

In selecting teaching methods, various methods and means should be flexibly adopted according to the learning situation, achieving an organic combination of theory and practice. Attention should also be paid to the fun of teaching content to stimulate students' interest and initiative in learning. Simulation teaching platforms can also allow students to experience the key points of PLC technology operation and enhance their professional skills through various teaching modes, such as experiential and collaborative approaches.

4.3. Establishing a diversified evaluation mechanism

In addition to traditional exam scores, more evaluation methods should also be introduced. For example, in accordance with the requirements of skill certificate certification, corresponding assessment stages can be set up. At the same time, teachers can organize students to participate in skills competitions and other activities and test their practical abilities and professional qualities through competition results. In addition, methods such as enterprise evaluation and student peer evaluation can be introduced to form a diversified evaluation mechanism.

5. Practical effects and experience summary

Through the teaching reform and practice of integrating job certification and competition courses, the teaching quality of PLC courses has been significantly improved. Students' practical ability and professional competence have been effectively improved, enabling them to better adapt to enterprises' employment needs. At the same time, through cooperation and communication with enterprises, teachers' professional competence has also been improved.

In the process of practice, the study has also accumulated some valuable experience. Firstly, attention should be paid to updating and adjusting course content to ensure synchronization with job requirements and technological development. Secondly, it is necessary to strengthen cooperation and communication with enterprises and jointly promote curriculum teaching reform and practice. Finally, attention should be paid to individual differences and interest characteristics of students, teaching according to their aptitude and stimulating their enthusiasm and enthusiasm for learning.

6. Conclusion

The teaching mode of integrating job certification and competition courses provides new ideas and methods for

the teaching of PLC courses in vocational schools. Students can effectively enhance their practical abilities and professional qualities by optimizing the course structure, updating course content, and establishing diversified evaluation mechanisms. In the future, the reform and practice of teaching models can be deepened that integrate job certification, competition, and courses, continuously explore teaching methods and means that are more in line with the needs of enterprises and the characteristics of students and make contributions to cultivating more high-quality skilled talents.

Disclosure statement

The author declares no conflict of interest.

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