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Teaching Reform of PLC Courses from the Perspective of New Quality Productivity

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Abstract

This paper focuses on the teaching reform of PLC courses from the perspective of new quality productivity. It analyzes the new requirements posed by new quality productivity for the course in terms of cultivating practical innovation capabilities, integrating intelligent and digital technologies, and interdisciplinary knowledge. The paper identifies current teaching issues such as outdated content, monotonous methods, weak practical training, and incomplete evaluation systems. Furthermore, it proposes reform pathways, including optimizing teaching content, innovating teaching methods, strengthening practical components, and improving evaluation systems. It also elaborates on safeguard measures such as enhancing faculty development, increasing resource investment, and deepening school-enterprise collaboration, aiming to cultivate high-quality technical and skilled talents that meet the demands of new quality productivity development.

Keywords: New quality productivity; PLC courses; Teaching reform

1. Introduction

With the rapid advancement of science and technology, new quality productivity has become a significant force driving socio-economic development. Characterized by high technology, high efficiency, and high quality, new quality productivity places higher demands on the cultivation of high-quality technical and skilled talents. PLC (Programmable Logic Controller), as a core control device in industrial automation, is widely used in fields such as industrial robotics and smart manufacturing. The teaching quality of PLC courses directly impacts students' professional competencies and employability. Under the perspective of new quality productivity, traditional PLC course teaching can no longer meet the needs of the times, making teaching reform imperative.

2. New Requirements for PLC Course Teaching Under New Quality Productivity

2.1. Strengthening Practical and Innovative Capabilities

The development of new quality productivity relies on continuous technological innovation and practical application. In industrial automation, enterprises require talents who can integrate PLC technology with real-world production scenarios to solve complex engineering problems and innovate applications. Therefore, PLC course teaching must go beyond theoretical knowledge dissemination and focus on cultivating students' practical and innovative abilities. Students should master PLC programming, debugging, and application techniques through hands-on practice and be capable of designing innovative control systems tailored to actual needs.

2.2. Integrating Intelligent and Digital Technologies

The core of new quality productivity lies in the deep integration of intelligent and digital technologies with the real economy. PLC technology is also evolving toward intelligence, networking, and digitization, increasingly intertwined with technologies such as industrial internet, artificial intelligence, and big data. Thus, PLC course teaching must incorporate these new technological elements, enabling students to understand PLC applications in smart production systems and master communication and collaborative control methods between PLCs and other intelligent devices. This fosters students' adaptability to intelligent production environments.

2.3. Emphasizing Interdisciplinary Knowledge Integration

The development of new quality productivity involves the convergence of multiple disciplines, such as mechanical engineering, electronic engineering, computer science, and control engineering. As a core control device in industrial automation, PLC applications also require interdisciplinary knowledge. Therefore, PLC course teaching should emphasize the integration of interdisciplinary knowledge, incorporating related fields like mechanical design, sensor technology, motor drives, and computer programming into the curriculum. This cultivates students' comprehensive competencies and problem-solving abilities across disciplines.

3. Current Issues in PLC Course Teaching

3.1. Outdated Teaching Content

Current PLC course content predominantly focuses on traditional PLC programming techniques and basic applications, lacking integration with intelligent and digital technologies. This creates a gap between teaching and actual industry needs. For example, in industrial robotics, topics like PLC communication and collaborative control with robotic systems are rarely covered, leaving graduates ill-prepared for real-world job demands.

3.2. Monotonous Teaching Methods

PLC courses primarily employ a "lecture + demonstration" approach, where students passively receive knowledge with limited opportunities for hands-on practice or innovative thinking. Lab sessions often consist of verification experiments where students follow predefined steps, hindering the development of practical and problem-solving skills.

3.3. Weak Practical Teaching Components

Practical training is a critical part of PLC courses, but many institutions face issues such as outdated or insufficient equipment and a disconnect between lab exercises and real-world production scenarios. Students rarely experience authentic industrial control environments, limiting the effectiveness of practical skill development.

3.4. Incomplete Evaluation System

Current evaluations rely heavily on theoretical exams and lab reports, failing to assess students' comprehensive abilities. This system prioritizes memorization over practical skills, innovation, and problem-solving, which are essential for meeting the demands of new quality productivity.

4. Pathways for PLC Course Teaching Reform Under New Quality Productivity

4.1. Optimizing Teaching Content

1 Integrate intelligent and digital technologies: Expand content to include PLC applications in industrial internet, AI, and big data, such as PLC communication with IoT platforms and AI-optimized control algorithms.

2 Enhance case-based teaching: Use real-world examples like PLC-controlled industrial robotic lines or smart warehouse systems to help students master practical applications.

3 Promote interdisciplinary knowledge: Incorporate mechanical design, sensor technology, and computer programming to build a cross-disciplinary curriculum.

4.2. Innovating Teaching Methods

1 Adopt project-based learning: Break the course into practical projects, such as designing a small automated production line, to foster hands-on and problem-solving skills.

2 Implement flipped classrooms: Shift theoretical learning to pre-class online materials, reserving class time for discussions and practical exercises.

3 Leverage virtual simulation: Use software to simulate industrial control environments for safe and immersive PLC training.

4.3. Strengthening Practical Teaching

1 Upgrade lab facilities: Invest in modern equipment and establish high-quality training bases, including partnerships with enterprises for real-world practice.

2 Design advanced experiments: Replace verification labs with comprehensive projects like PLC-robot collaborative control or remote monitoring via industrial internet.

3 Encourage competitions and innovation: Organize PLC-related contests and entrepreneurial activities to spark creativity and practical engagement.

4.4. Improving Evaluation Systems

- 1 Diversify assessment methods: Combine exams, practical tasks, project reports, and class participation for a holistic evaluation.
- 2 Focus on process evaluation: Track student progress during projects and labs, providing timely feedback for improvement.
- 3 Involve industry experts: Collaborate with enterprises to assess students' practical skills and professional readiness.

5. Safeguard Measures for PLC Course Teaching Reform

5.1. Enhancing Faculty Development

- 1 Recruit experienced professionals: Hire instructors with industry expertise to enrich the teaching team.
- 2 Provide ongoing training: Organize workshops on PLC advancements and industry trends to keep faculty updated.
- 3 Support teaching research: Encourage faculty to explore innovative teaching models aligned with new quality productivity.

5.2. Increasing Resource Investment

- 1 Modernize facilities: Upgrade PLC labs and virtual simulation tools to enhance learning environments.
- 2 Develop high-quality materials: Create textbooks, videos, and simulations tailored to new productivity demands.
- 3 Build online platforms: Establish digital learning portals for flexible and interactive education.

5.3. Deepening School-Enterprise Collaboration

- 1 Co-design curricula: Work with enterprises to align course content with industry needs.
- 2 Form joint teaching teams: Invite industry experts to co-teach, bridging theory and practice.
- 3 Establish training bases: Offer students internships in real production settings while supplying enterprises with skilled talent.

6. Conclusion

Under the perspective of new quality productivity, reforming PLC course teaching is essential to cultivate high-quality technical talents. By optimizing content, innovating methods, strengthening practice, and improving evaluations—supported by faculty development, resource investment, and school-enterprise

collaboration—PLC education can better equip students with the skills needed for intelligent production environments.

Future reforms must continue to track industry trends and technological advancements, ensuring the curriculum evolves to meet the ever-changing demands of new quality productivity and contributes to nurturing top-tier industrial robotics professionals.

Declaration of Conflicting Interests

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