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Construction of a "Course-Position-Certificate-Competition" Integrated Curriculum System in Higher Vocational Intelligent Construction Technology

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Abstract: With the transformation and upgrading of the construction industry, intelligent construction technology is an important direction for the development of the construction industry under the rapid development of digitalization and intelligent technologies. To meet the development needs of new technologies, industries, and formats, the curriculum system and teaching content of higher vocational intelligent building technology urgently need updating. This paper analyzes the main issues in the construction process of the curriculum system and proposes specific strategies based on the integration of "course-position-certificate-competition", enhancing the effectiveness and importance of this integrated curriculum system in talent training through the analysis of teaching outcomes and industry feedback.

1. Introduction

With the increasing demand for highly skilled technical talents, higher vocational education, as an important base for the cultivation of skilled talents, should improve the quality and efficiency of talent training through educational and teaching reforms. The construction of the curriculum system is crucial for talent cultivation. Under the background of new engineering disciplines, the curriculum system construction of intelligent construction technology still faces many challenges. In 2021, the National Vocational Education Conference first proposed the new requirements of integrated education of "position-course-competition-certificate"; the integration of "course-position-certificate-competition" has epochal significance, allowing the curriculum system to achieve a balance of theory and practice and integration of work and study for technical skill talent cultivation[1]. The construction of a "course-position-certificate-competition" integrated curriculum system has become key to adapting to industry development and meeting enterprise demands. This system organically integrates four components: course learning, position practice, qualification certification, and skills competition, enhancing teaching quality and strengthening students' practical abilities to meet industry and enterprise demands for talent cultivation, and promoting deep cooperation between schools and enterprises.

2. Common Issues in Constructing Curriculum Systems for Higher Vocational Intelligent Construction Technology Programs

2.1. Mismatch between Curriculum Content and Industry Needs

2.1.1. Disconnection between Theory and Practice

In the field of higher vocational intelligent construction technology, cultivating students' practical abilities is crucial. During the curriculum system construction process, a common issue is the disconnection between theoretical teaching and practical application. Curriculum systems that overemphasize theoretical knowledge while neglecting hands-on training not only reduce students' interest and motivation but also affect their efficiency in transforming theoretical knowledge into practical skills, deviating from the holistic education goals. In today's rapidly developing intelligent construction technology field, the lack of sufficient practical opportunities means students cannot timely understand and master the application of the latest technologies and tools, leading to significant employment challenges after graduation.

2.1.2. Lag in Updating Curriculum Content

Another prominent issue is the lag in updating curriculum content to match the latest industry developments. Knowledge and technology in the intelligent construction technology field are evolving at an unprecedented rate, which demands that related curriculum content be continuously updated to ensure students learn the most cutting-edge industry knowledge. However, due to various reasons including lengthy textbook compilation and approval processes, and insufficient opportunities for teacher continuing education and training, it is challenging to synchronize educational content with industry development, thereby affecting students' learning outcomes and future career development. Students' inability to encounter the latest industry technologies and trends during their studies not only diminishes their competitive edge in employment but also reduces their potential to contribute to innovative developments in the intelligent construction field.

2.2. Lack of Teaching Facilities and Qualified Teachers

2.2.1. Lack of Modern Teaching Facilities

In the education process for higher vocational intelligent construction technology, the lack of modern teaching facilities is a significant factor restricting students' learning outcomes and skill enhancement. Learning and research in the intelligent construction field heavily depend on advanced software tools and hardware equipment, such as 3D modeling software, Building Information Modeling (BIM) technology, and Virtual Reality (VR) and Augmented Reality (AR) devices. Effective learning and application of these technologies require schools to provide the necessary hardware facilities and software resources. However, due to insufficient funding and long upgrade cycles, many vocational colleges fall short in this aspect, unable to provide students with ample practical operation opportunities. This directly impacts students' mastery of intelligent construction technology applications, limiting their comprehensive skill development and training, and deviating from job target requirements.

2.2.2. Delay in Developing High-Quality Teaching Staff

The quality of teaching staff is a key guarantee for educational quality, and the development of high-quality teaching staff in higher vocational intelligent construction technology also faces

challenges. On one hand, the rapid development of intelligent construction technology demands higher professional knowledge and skills from teachers, requiring continuous learning and training to keep pace with technological advancements. However, in reality, the lack of systematic continuing education mechanisms and effective teacher development plans means that teachers often cannot update their professional knowledge as fast as the industry progresses. On the other hand, under the new engineering disciplines, the cultivation of talents in intelligent construction technology demands higher comprehensive abilities from teachers, including interdisciplinary knowledge integration, project management, and the ability to communicate and collaborate with enterprises. The current shortage of teachers with such comprehensive qualities leads to a phenomenon where courses are tailored to available teachers, restricting the rational construction of the curriculum system and affecting the quality of talent cultivation.

2.3. Imperfect School-Enterprise Cooperation Mechanisms

2.3.1. Single Cooperation Mode

In higher vocational intelligent construction technology programs, the school-enterprise cooperation mode tends to be simplistic, often limited to basic internships or corporate lectures, lacking in-depth and diversified cooperation models. This single mode of cooperation fails to meet the needs of both education and industry, especially in the rapidly developing field of intelligent construction, where students require a comprehensive, practical learning experience. The singular cooperation mode restricts the development of students' practical and innovative abilities and weakens the close connection between educational content and actual industry needs, impacting the effectiveness of the curriculum system and educational quality.

2.3.2. Low Degree of Enterprise Involvement

Another significant issue is the low degree of enterprise involvement. Although many enterprises recognize the potential value of cooperation with vocational colleges in talent cultivation and technological research and development, their actual participation remains low. Reasons vary, including unclear expectations of return on educational investments, imperfect cooperation mechanisms, lack of effective communication channels, and a misalignment between enterprises' requirements for student practical abilities and educational goals of schools. This situation poses multiple challenges for school-enterprise cooperation, such as limited quality and effectiveness of student internships and training, and a mismatch between graduates' skills and enterprise needs, thereby affecting students' employment rates and job quality. Therefore, exploring and establishing diversified school-enterprise cooperation models and increasing enterprise participation are crucial for enhancing the effectiveness of the "course-position-certificate-competition" integrated curriculum system implementation.

3. Strategies for Constructing an Integrated "Course-Position-Certificate-Competition" Curriculum System in Higher Vocational Intelligent Construction Technology Programs

3.1. Ensuring Course Content Meets Industry Demands

3.1.1. Strengthening the Integration of Theory and Practice

Faculty teams in higher education institutions, based on in-depth enterprise research and in line with enterprise job targets, determine talent cultivation objectives and curriculum systems according to job requirements. Course designs are closely related to industry needs, and teaching plans are

professionalized by integrating job tasks into the educational process, allowing students to deepen their understanding and application of theoretical knowledge while completing these professional tasks. By analyzing real industry cases, students learn in real work scenarios, enhancing their learning experience and the authenticity of skill training, thus closely linking the teaching process with the production process. The construction of the curriculum system should allocate a reasonable proportion of practical hours, increasing the weight of experiments, internships, and hands-on training, especially for practice projects in cooperation with enterprises, providing students with direct exposure to and understanding of the latest industry developments. These methods not only enhance students' professional skills but also stimulate their innovative thinking and problem-solving abilities.

3.1.2. Updating Course Content in Real-Time

Higher vocational colleges should establish a rapid response mechanism to regularly collect and analyze trends in industry development, technological advances, and enterprise needs. Institutions can set up industry advisory councils with industry experts and corporate representatives participating in the curriculum construction and update process, ensuring the timeliness and foresight of course content. The content of professional qualifications and vocational skill certificates directly corresponds to the professional knowledge, vocational skills, and professional qualities needed for real job positions or groups of positions. Integrating these certificate contents into teaching materials ensures that courses reflect new technologies, new processes, and new requirements, with professional and market-oriented characteristics. Utilizing digital technology and online resources, such as open online courses, professional websites, and databases, provides teachers and students with the latest learning materials and industry information. Additionally, encouraging teachers to continuously pursue professional development and participate in industry training and conferences allows them to bring the latest industry knowledge and skills back to the classroom. Implementing these measures effectively ensures the timely update of course content, improving the quality of education and students' employability.

3.2. Deepening Enterprise Cooperation to Strengthen Teaching Facilities and Faculty

3.2.1. Increasing Investment in Teaching Facilities

To meet the teaching needs of the intelligent construction technology program, increasing investment in teaching facilities is a crucial strategy. Schools should update and add advanced laboratory equipment, purchase industry-standard software tools, and build training bases that simulate real work environments, such as investing in Virtual Reality (VR) and Augmented Reality (AR) technology equipment, allowing students to master complex construction processes and operational skills through simulated experiences. Additionally, deepening cooperation with enterprises can move classroom teaching into corporate settings, not only utilizing corporate facilities as temporary teaching facilities but also providing students with a real work experience, enhancing the quality and efficiency of teaching while stimulating students' interest and practical abilities.

3.2.2. Strengthening Faculty Development

A high-quality faculty is key to improving educational quality. Thus, strengthening the development of faculty in the intelligent construction technology program is a crucial strategy for implementing the integrated "course-position-certificate-competition" curriculum system. Firstly, industry professionals and technical experts should be invited to join the teaching staff, serving as corporate mentors and advisors to the teaching team. Additionally, faculty members should regularly engage with enterprises to acquire new industry information, technologies, and firsthand teaching

cases. They should also participate in professional training and academic exchanges, including industry seminars and workshops, to keep their knowledge and skills up-to-date. Furthermore, establishing a teacher performance evaluation mechanism based on teaching outcomes, student feedback, and professional contributions can effectively enhance teaching quality and motivate faculty. Through these measures, a highly skilled faculty that excels in both technology and teaching can be developed, providing students with high-quality education.

3.3. Enhancing Students' Practical Abilities and Innovation

3.3.1. Expanding Internship and Training Platforms

Enhancing students' practical skills is key to expanding and enriching the scale and quality of internship and training platforms. This includes establishing more internship partnerships with enterprises, especially those leading in the field of intelligent construction, so students can engage with cutting-edge technologies and projects. Additionally, establishing or upgrading on-campus training bases that simulate real work environments provides students with diverse practical operation opportunities. Encouraging students to participate in national and international vocational skills competitions and innovative projects not only exercises their technical and practical skills but also stimulates their innovative thinking and teamwork abilities, achieving the objective of using competitions to promote training and learning.

3.3.2. Establishing an Innovative Education Mechanism

Creating an innovative education mechanism aims to cultivate students' innovative consciousness and abilities. This can be achieved by introducing interdisciplinary courses that encourage students to solve problems by integrating intelligent construction technology with knowledge from other fields. Furthermore, in cooperation with enterprises, "innovation labs" or "makerspaces" can be created, providing the necessary resources and guidance for students to freely explore and experiment with new ideas[2]. Schools should also establish innovation project funds to support students in turning creative ideas into practical projects. Through these mechanisms, students can develop a spirit and ability of exploring the unknown and continuously innovating during their learning process, fulfilling the comprehensive educational objective of nurturing morally, intellectually, and practically skilled individuals.

3.4. Optimizing School-Enterprise Cooperation Mechanisms

Optimizing school-enterprise cooperation mechanisms first requires constructing diversified cooperation models, such as joint research and development projects, corporate mentorship programs, enterprise practice bases, and bilateral exchange plans. Through these varied cooperation methods, schools can more effectively utilize enterprise resources to provide students with practical learning and internship opportunities, while also enabling enterprises to directly participate in the talent cultivation process, thereby achieving a closer alignment of educational content with industry demands and matching teaching standards with industry standards.

Higher vocational colleges and enterprises should establish more direct and efficient communication channels to deepen school-enterprise cooperation, allowing enterprises to better provide various teaching resources and schools to more effectively cultivate talented graduates. Additionally, by clearly demonstrating the mutual benefits of school-enterprise cooperation, such as enhancing corporate brand image through partnership and gaining priority access to excellent graduates by participating in the talent cultivation process, enterprises can be motivated to engage more actively. Further promoting enterprise involvement can be achieved by establishing cooperative

reward mechanisms, offering policy and financial support and incentives to enterprises that actively participate in school-enterprise cooperation, thereby encouraging deeper enterprise involvement in educational activities.

4. The Application Effectiveness of the "Course-Position-Certificate-Competition" Integrated Curriculum System in Higher Vocational Intelligent Construction Technology Programs

4.1. Enhancement of Student Capabilities

Following the implementation of the "Course-Position-Certificate-Competition" integrated curriculum system, the capabilities of students in higher vocational intelligent construction technology programs have significantly improved. Firstly, students' professional skills have notably strengthened; project-based training in cooperation with enterprises enables them to apply theoretical knowledge in real work environments and master the latest intelligent construction technologies and tools. Surveys from employing enterprises indicate a 12% improvement in students' professional skills. Secondly, problem-solving abilities and innovative thinking have been enhanced, with internal assessment reports showing a 15% increase in students' ability to independently devise solutions[3]. In the "competition" component, students must think independently and propose innovative solutions, which not only exercises their technical skills but also cultivates decision-making abilities. Student enthusiasm for participation in competitions and the rate of winning awards have also progressively increased. The pass rate for the 1+X vocational skills certification has improved by 7% over the past two years. Feedback from graduates shows a 93% satisfaction rate with the curriculum system.

4.2. Improvement in Teaching Quality

After the implementation of the "Course-Position-Certificate-Competition" integrated curriculum system, the teaching quality in higher vocational intelligent construction technology programs has significantly increased. Industry feedback confirms that the curriculum content is updated synchronously with industry demands, ensuring the foresight and practicality of teaching content. Innovations in teaching methods have enhanced student interest and engagement, with surveys indicating a 22% increase in student interest. Through school-enterprise cooperation, students have the opportunity to participate in real projects, making learning more targeted and effective. Regular teaching evaluations and timely feedback collection enable educators to adjust teaching strategies and content, with an outstanding teaching quality rate among professional teachers reaching 98%.

4.3. Enterprise Satisfaction

The implementation of the "Course-Position-Certificate-Competition" integrated curriculum system has significantly increased enterprise satisfaction with graduates from higher vocational intelligent construction technology programs, with a 2023 industry satisfaction survey showing a satisfaction rate of 92%. Enterprises report that graduates trained through this curriculum system not only possess solid professional knowledge but also have strong practical abilities and a spirit of innovation. These graduates quickly adapt to the technical and work environments of enterprises, effectively solve problems, and play key roles in advancing projects. Particularly noteworthy is the high regard enterprises have for students' teamwork and communication skills, considered indispensable for the success of interdisciplinary and interdepartmental projects, with the success rate of team projects also improving.

5. Conclusion

By analyzing the issues in the construction of the curriculum system for higher vocational intelligent construction technology programs and proposing strategies based on the "Course-Position-Certificate-Competition" integration, it is evident that this curriculum system is effective and important for talent cultivation. The integration of "Course-Position-Certificate-Competition" not only helps to address current issues but also provides new ideas and methods for the innovative development of higher vocational education curriculum systems. Moving forward, as intelligent construction technology continues to advance and industry demands evolve, the construction and optimization of the curriculum system will be an ongoing process, requiring the joint efforts and close cooperation of educators, industry enterprises, and government agencies.

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