Journal of Contemporary Educational Research, 2024, Volume 8, Issue 9
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

Discussion on the Integration of "Post, Course, Competition, Certificate": Taking the Internet of Things Application Technology Courses in Higher Vocational Colleges as an Example

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Abstract: This article explores the development of the Internet of Things (IoT) application technology course in higher vocational colleges under the background of "post, course, competition, certificate." It first emphasizes the importance of IoT talent training and course construction in higher vocational colleges and deeply analyzes the core concept of "post, course, competition, certificate" integration. In view of the problems faced in the course construction of IoT application technology in higher vocational colleges and the practical experience of Tianjin Vocational College of Mechanics and Electricity, the implementation strategy of the course construction of IoT application technology in higher vocational colleges is elaborated in detail based on the integrated concept of "post, course, competition, certificate."

Keywords: Post, course, competition, certificate; Course construction; Integration of industry and education

Online publication: September 25, 2024

1. Introduction

The new quality productivity [1] refers to the new, revolutionary, and innovative productive factors or forms emerging in the social production process. The Internet of Things (IoT) technology is an essential part of the new quality productivity. The talent demand in the IoT technology field exhibits increasingly diversified, professional, and composite characteristics.

The "post, course, competition, certificate" training mode and the talent training process of higher vocational colleges promote and complement each other, jointly enhancing the quality of talent and providing strong support for the development of new quality productivity. In turn, the development of new quality productivity will also promote continuous innovation and improvement of the talent training mode, enhancing students' professional skills and employment competitiveness. At the same time, this model helps cultivate more high-quality technical and skilled talents to meet the employment needs of enterprises in the industry.

2. In-depth analysis of the comprehensive talent cultivation model of "post, course, competition, certificate"

2.1. The background of "post, course, competition, certificate"

The background of the "post, course, competition, certificate" model is multifaceted, encompassing not only the demands of economic and social development but also the requirements for reform and development within vocational education itself, as well as the promotion and support of national policies.

The state has attached great importance to the development of vocational education and has successively issued a series of policy documents to promote its reform and innovation. The introduction of these policies has provided a solid foundation for the implementation of the "post, course, competition, certificate" model. At the National Vocational Education Conference in April 2021, the importance of further advancing the "Three Teachings" reform was emphasized, and the strategic guideline of comprehensively implementing the "post, course, competition, certificate" approach to holistic education was fully implemented. This approach takes into account the vocational education and training systems at the secondary vocational, higher vocational, and undergraduate levels.

To promote the comprehensive and high-quality development of modern vocational education, the General Office of the CPC Central Committee and the General Office of the State Council jointly issued the "Opinions on Promoting the High-Quality Development of Modern Vocational Education" in October 2021. The document clearly points out the criticality of improving the comprehensive education mechanism of "post, course, competition, certificate" and requires that curriculum design and development be closely integrated with actual industry needs and job characteristics to further drive the high-quality development of modern vocational education [2].

2.2. The connotation of integration of "post, course, competition, certificate"

As an essential component of vocational education, "post, course, competition, certificate" encompasses specific job positions, corresponding course systems, vocational skills competitions, and vocational skills level certificates. The integration of "post, course, competition, certificate" achieves a close connection between industry and majors, as well as between job positions and courses, thereby further enhancing the adaptive cultivation of talents [3].

In the integrated system of "post, course, competition, certificate," the logical relationships among the various elements are close and interdependent. "Post" provides a clear direction for skill learning; "Course" serves as the foundation for skill learning; "Competition" acts as a benchmark for skill learning, allowing for the verification of learners' skill levels; and "Certificate" represents the industry validation of skill learning. This logical relationship helps to construct a complete, scientific, and efficient talent cultivation system, providing a solid talent guarantee for the steady development of the industry. **Figure 1** illustrates the relationship diagram between posts, courses, competitions, and certificates.

Through this diagram, the inherent connections and mutual influences among the various elements can be seen, which can assist vocational colleges in better formulating educational and teaching plans and enhancing the quality of talent cultivation.

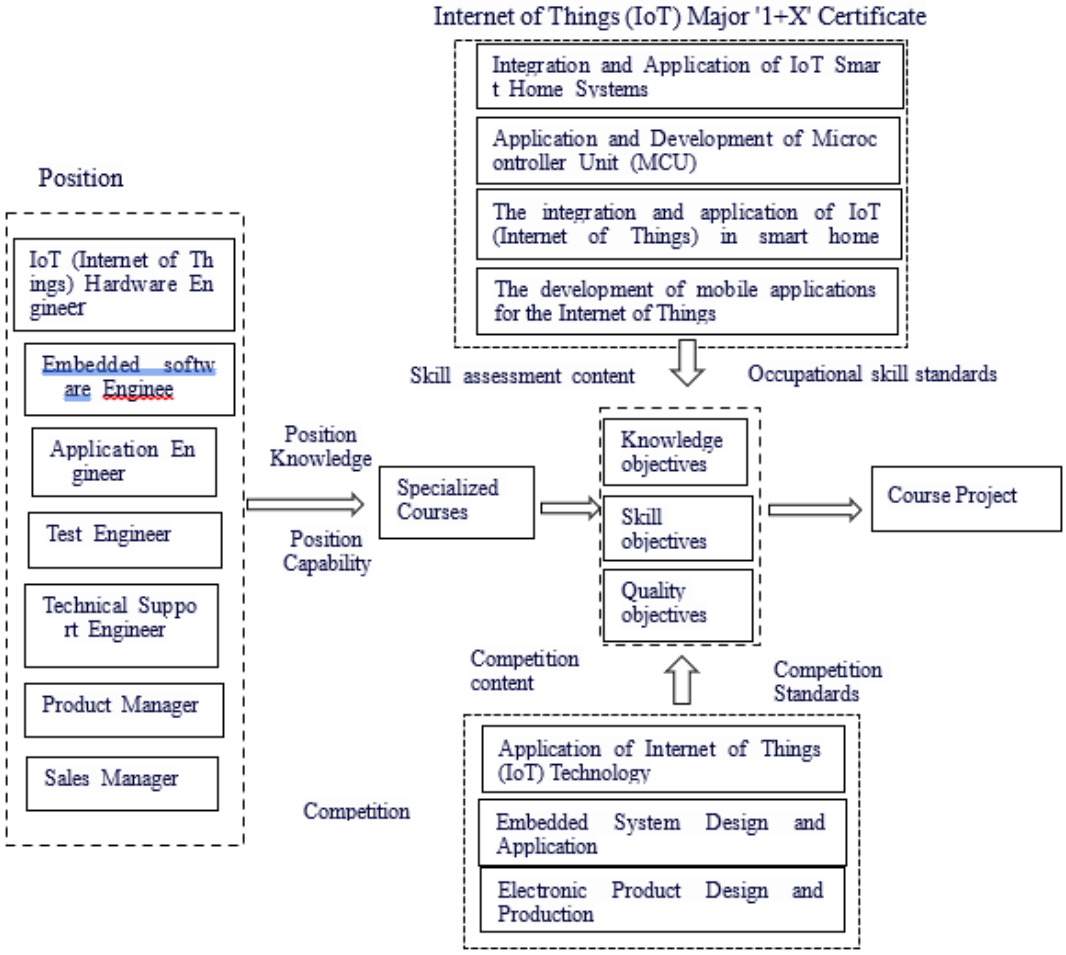

Figure 1. The relationship between posts, courses, competitions, and certificates

3. Establishing an industry-education integration base and continuously strengthening curriculum development

Industry-education integration is a teaching model that deeply combines industry and education, aiming to bridge the gap between traditional education and actual industries and more effectively enhance students' practical operation skills and innovation and entrepreneurship capabilities [3]. The core element of the comprehensive talent cultivation model of "post, course, competition, certificate" is "Post," which refers to closely focusing on job demands and enhancing students' abilities to perform job duties through deepening the integration of industry and education.

The main product of the enterprise implementing industry-education integration is the smart camera used in intelligent security. By decomposing the work tasks in the field of smart cameras in detail, the relationship between job titles, job responsibilities, and course settings can be obtained, as shown in **Table 1**.

Based on the corresponding relationship in **Table 1**, job responsibilities can be converted into specific course content, thus realizing the guidance of job content to course content.

Table 1. Correspondence between job titles, responsibilities, and course settings

Job titles	Job responsibilities	Course settings
Hardware engineer	Responsible for the hardware design and development of smart cameras, including circuit board design, component selection, and hardware testing.	Fundamentals of Electronics, Circuit Analysis, Digital and Analog Circuits, Microcomputer Principles and Interfaces, Signal Systems
Embedded software engineer	Responsible for the software development and maintenance of embedded systems for smart cameras, including driver development, system integration, and performance optimization.	Principles of Embedded Systems, Embedded Operating Systems, C/C++ Programming, Data Structures and Algorithms, Principles and Applications of Microprocessors/Microcontrollers
Application software engineer	Responsible for the design and development of application software for smart cameras, including interface design, feature implementation, and user experience optimization.	Software Engineering, Object-Oriented Programming, User Interface and User Experience Design, Database Principles and Practice, Computer Network Technology
Test engineer	Responsible for the testing of smart cameras, including functional testing, performance testing, stability testing, etc., to ensure that products meet the expected quality standards.	Software Testing Techniques, Hardware Testing Methods, Test Case Design and Execution, Automated Testing Practices, Testing Tools and Equipment Operation Guidelines
Technical support engineer	Responsible for after-sales technical support for smart cameras, including answering customer questions, troubleshooting, and system maintenance.	Customer Service and Communication, Technical Support and Troubleshooting, Electronic Equipment Repair
Product manager	Responsible for the planning and management of smart camera products, including market research, product positioning, demand analysis, product iteration, etc.	Market Promotion, Product Operations, Consumer Behavior, Market Research
Sales manager	Responsible for the sales and marketing of smart cameras, including customer acquisition, sales channel development, and market promotion.	Market Promotion, Sales Techniques, Business Negotiation, Marketing and Promotion Strategies

4. The coordination between the “1 + X” certificate and course construction

The “1 + X” certificate system aims to enable vocational college students to obtain multiple vocational skill level certificates as well as academic certificates, forming a comprehensive education mechanism. This system is intended to motivate students to simultaneously acquire diversified vocational skills during their academic education, thereby enhancing their competitiveness in the job market and their adaptability to future careers [4].

4.1. Formation of the integrated curriculum for the “1 + X” certificate system

Taking the vocational skill level certificate for IoT sensor network application development as an example, the formation process of the “1 + X” certificate integrated curriculum is explained. The definition process of the content of the certificate-integrated curriculum involves interpreting the corresponding vocational skill level certificate to obtain the core knowledge and skill points of the corresponding vocational skill level certificate. The operational process for forming the certificate-integrated curriculum is shown in **Figure 2**.

4.2. Construction logic of talent cultivation mode based on the integration of documentary evidence

When constructing curricula, vocational colleges need to use these knowledge points as important references. At the same time, they also need to introduce the training content and mode of vocational skill level certificates. Furthermore, they need to refer to the evaluation standards of vocational skill level certificates to construct a curriculum evaluation system that is closely connected with certificate evaluation. With the integration of

certificates and curricula as the core, a set of construction logic for talent cultivation models is formed, as shown in **Figure 3**.

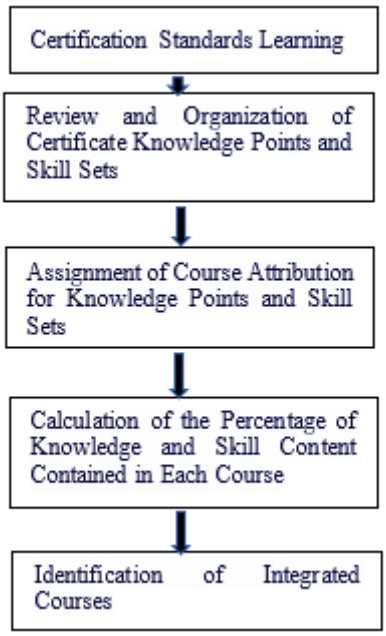

Figure 2. The formation process of the IoT certificate-integrated curriculum

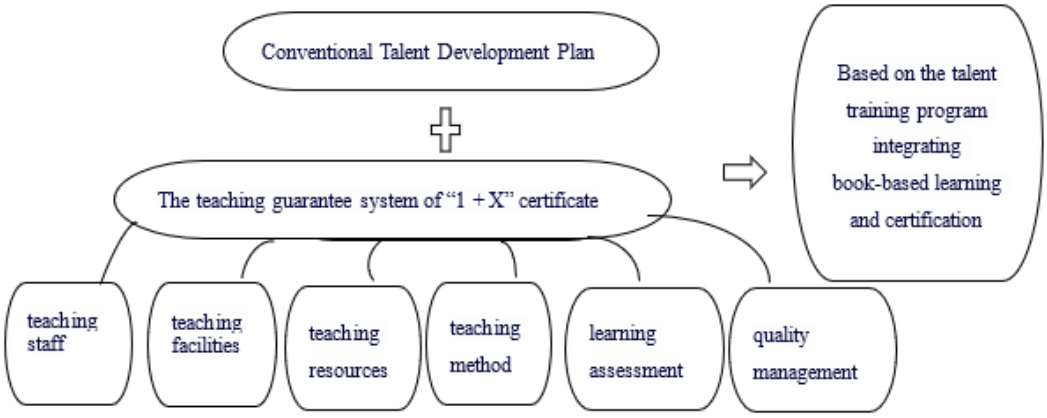

Figure 3. The construction logic of the talent cultivation model based on the integration of book and certificate

5. Promotion of curriculum development through skill competitions

Skill competitions, which encompass both vocational college skill competitions and related industry competitions, are a crucial aspect of vocational education reform. These programs provide students with a broader performance platform. Skill competitions and curriculum construction complement each other, jointly promoting the progress of professional IoT application technology.

(1) Leading role of skill competitions in curriculum construction: First of all, skill competitions can reflect the latest trends and technical requirements of industry development, thereby providing important references for curriculum construction. Secondly, skill competitions have a positive effect in stimulating students' interest and enthusiasm for learning. At the same time, success and honors in competitions can also enhance students' self-confidence and sense of accomplishment, laying a solid foundation for

their future development [5].

(2) Construction of "Printed Circuit Board (PCB) Design and Fabrication" as an example: The teaching of the "PCB Design and Fabrication" course mainly follows the traditional model, with a focus on the explanation of theoretical knowledge. However, from the perspective of teaching effectiveness, the existing teaching content still needs to be improved and optimized.

Here, combining the content of the skill competition "PCB Design and Fabrication," significant reforms are proposed in terms of teaching arrangement, teaching content, teaching methods, and assessment methods. The specific changes are shown in **Table 2**.

Table 2. Comparison of "PCB Design and Fabrication" course before and after curriculum reform implementation

Project timeline	Teaching arrangement	Teaching content	Teaching method	Assessment method
Before reform	Theoretical teaching	Basic concepts, composition, production process, and related design principles and techniques of printed circuit boards.	Theoretical teaching + computer room experiments	Daily performance 30% + final exam 70%
After reform	Concentrated practical training	Topic assignment, demand analysis, circuit design, component selection, routing design, board layout creation, etching, soldering, and testing	With a student-centered approach, students complete project tasks through group cooperation. Teachers guide students by emphasizing the cultivation of their abilities to analyze and solve problems, thereby enhancing their innovative thinking and practical skills.	Project completion evaluation: Evaluation based on the completion of project tasks, combined with project quality. Teamwork collaboration: Assessment of students' ability to collaborate and their division of labor within the project. Innovative ability: Evaluation of students' display of innovative thinking, hands-on skills, and other aspects of performance within the project.

Through the implementation of the above design plan, the "PCB Design and Fabrication" course became more focused on hands-on practical experience, effectively enhancing students' professional skills and overall qualities.

6. Reform achievements

Through project implementation, the project team has achieved remarkable results in education and teaching reform. At the teaching level, the quality of the talent cultivation program has achieved a qualitative leap, with curriculum design becoming more rational, curriculum content optimized, and the connection between courses tightened. The main line of the curriculum is clear and definite, effectively enhancing students' theoretical literacy and practical operation capabilities. In terms of teaching effects, IoT graduates have demonstrated high overall quality, and students have achieved outstanding results in professional-related competitions, winning a total of 28 provincial and above-provincial awards in the past two years.

7. Conclusion

In conclusion, the integration of "post, course, competition, certificate" provides new ideas and directions for the cultivation of technical and skilled talents in higher vocational colleges, which can promote the reform of higher vocational education and teaching, and cultivate more high-quality, socially demanded technical and

skilled talents.

Funding

2021 Tianjin Educational Science Planning Project "Research and Practice of Talent Cultivation Mode for IoT Majors in Higher Vocational Colleges under the Guidance of the '1 + X' Certificate System" (CJE210237)

Disclosure statement

The author declares no conflict of interest.

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