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Research on the Teaching Reform Practice of "Curriculum-Certificate-Competition-Post" Integration in IoT Major of Higher Vocational Colleges from the Perspective of Credit Bank

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Abstract: To address the practical challenges in integrating the "Curriculum-Certificate-Competition-Post" (CCCP) model with the credit bank in the Internet of Things (IoT) major of higher vocational colleges, this study is based on the literature related to the vocational education credit bank. By adopting methods such as literature research and case analysis, it sorts out the policy background and research status of the integration between the credit bank and the CCCP model, defines core concepts, and relies on theories like competency-based education to analyze the practical dilemmas of the IoT major in terms of institutional standards, curriculum teaching, technology platforms, and subject participation, as well as the causes at the policy, institutional, and industrial levels. The research shows that the IoT major needs to promote reform through a four-dimensional strategy: improving the detailed rules for credit recognition of the CCCP model, reconstructing a modular curriculum system, optimizing the credit bank technology platform, and enhancing the participation motivation of relevant subjects. This study provides a practical path for the IoT major in higher vocational colleges to realize the integration of the CCCP model relying on the credit bank, and also offers a reference for the application of the credit bank in emerging majors of vocational education.

1. Introduction

Against the in-depth national vocational education reform, policies like the National Vocational Education Reform Implementation Plan and Education Power Construction Plan Outline (2024-2035) urge accelerating the national vocational education credit bank and integrating the "1+X" certificate system with academic education to broaden technical talents' development channels. Higher vocational colleges have explored such integration, laying a foundation for the CCCP model.

However, bottlenecks exist: no unified national qualification framework, fragmented credit standards, insufficient platform support, and weak school-enterprise collaboration. As a

"storage-recognition-conversion" platform, the credit bank integrates diverse learning achievements. It is crucial for solving these dilemmas, especially for IoT majors, to realize achievement mutual recognition and align teaching with industry standards.

2. The Necessity of the Credit Bank in the Integration of the CCCP Model

2.1 Urgent Need to Address the Practical Dilemmas in the Integration of the CCCP Model

Currently, the CCCP model integration faces multi-dimensional dilemmas. In terms of standards, there is no unified basis for recognizing achievements in each link: Xing Jiequn noted that Ningxia Vocational College of Art lacks accurate references for converting different "1+X" certificates to curriculum credits, with emerging certificate assessment points often exceeding syllabi[1]; Liu Qin mentioned vague conversion standards for vocational qualification certificates and competition achievements in Water Conservancy and Hydropower Construction major, causing disconnections between "curriculum-certificate" and "curriculum-competition"[9].

In terms of platforms, Weng Yan took Sichuan Huaxin Modern Vocational College as an example, showing existing teaching platforms fail to centrally store and efficiently convert CCCP achievements, with data lag and poor compatibility hindering circulation[3][4]. In collaboration, Fan Chunbin pointed out insufficient enterprise participation in E-commerce major's "school-enterprise co-construction" courses, making it hard to integrate "post" needs into the system[6].

Fortunately, the credit bank can resolve these dilemmas by formulating unified standards, building exclusive platforms, and establishing multi-subject collaboration mechanisms, laying a basic framework for CCCP integration.

2.2 Unique Advantages in Supporting the Efficient Advancement of the Integration of the CCCP Model

The credit bank has irreplaceable advantages in CCCP integration.In achievement integration, it uniformly manages "curriculum" (academic achievements), "certificate" (1+X certificates), "competition" (skill awards), and "post" (enterprise internships). For instance, Hong Ran connected the Sensor Network Application Development Certificate with ARM-Based Application Development course credits via the credit bank in IoT major practice, realizing "curriculum-certificate" mutual recognition[10].

In flexible conversion, based on Fang Lin's framework, it sets quantitative rules[7]. For fast-tech-iteration majors like IoT, it updates CCCP standards in real time. Guo Zhaoliang noted this enables quick responses to industrial changes, avoiding disconnection between CCCP integration and industry development[5].

2.3 Inevitable Choice of Learning from Domestic and Foreign Credit Bank Practice Experience

The Domestic and international credit bank practices offer reference models for CCCP integration, emphasising the necessity of introducing credit banks. Internationally, the European ECTS system links vocational education and skill certification via unified credit standards, while the U.S. credit bank includes enterprise internships and competition achievements in credit recognition, providing an international perspective for CCCP integration.

Domestically, at the regional level, Beijing, Jiangsu, Guangdong and other regions have developed qualification frameworks with significant level differences, and Ningxia has established

a vocational education credit bank alliance to achieve CCCP standard co-construction, cross-school recognition and resource sharing; the Yangtze River Delta also promotes inter-regional CCCP integration through regional credit banks[2]. At the institutional level, Sichuan Huaxin Modern Vocational College and other schools have explored CCCP achievement management and curriculum development based on credit banks. These experiences all rely on credit banks, further confirming their necessity.

3. Design of the Integration Standard Framework of the CCCP Model Based on the Credit Bank

3.1 Design Principles of the Integration Standard Framework of the CCCP Model

The CCCP integration standard framework adopts systematicness, adaptability, and dynamics as core principles to ensure theoretical rigour and practical operability. It builds a closed-loop system covering achievement recognition, conversion, storage, and application along the "Curriculum-Certificate-Competition-Post" chain, clarifying link-specific standards and connection logic while integrating the credit bank's "storage-calculation-conversion" functions for in-depth CCCP-credit integration.

Adaptability-wise, it differentiates designs: IoT majors (fast tech iteration) emphasize certificate-curriculum dynamic matching; E-commerce majors (operation-focused) highlight post practice achievement weight to avoid "one-size-fits-all" issues. Dynamically, it adjusts with industry and education reforms, regularly updates CCCP competency indicators/credit rules, and reserves interfaces for emerging certificates, competitions, and posts to ensure long-term applicability.

3.2 Conversion and Recognition Standards for Diversified Learning Achievements of the CCCP Model

Clear conversion rules and quantitative standards are formulated by achievement type to ensure all learning achievements are measurable and mutually recognizable. For "curriculum" (academic achievements), course hours and assessment results are core bases: 1 basic credit for 18 hours of theoretical courses and 1 practical credit for 30 hours of practical courses. Credits fluctuate with assessment—0.2 extra for excellent (≥90 points), 0.1 for good (80-89 points), and no extra for qualified (60-79 points)—ensuring standardized and differentiated calculation.

For "certificate" (1+X certificates), credits are assigned by grade and professional relevance: 1-2 for primary, 2-3 for intermediate, and 3-4 for advanced certificates. Core competency-related certificates (e.g., IoT's Sensor Network Application Development Certificate) get an extra 0.5-1 credit, with a 3-year validity requiring review or supplementary learning for renewal.

For "competition" (skill awards), recognition depends on level and rank: 4-2 credits for national awards (1st-3rd), 3-1 for provincial, and 1.5-0.5 for school-level (1st-2nd), with no repeated recognition (highest rank adopted).

For "post" (enterprise practice), on-the-job internships earn 1 credit/30 hours; internship internships get 3, 2, or 1 credit for excellent, good, or qualified enterprise assessments, respectively, verified via enterprise-issued reports and certificates.

3.3 Implementation Guarantee Mechanism of the Integration Standard Framework of the CCCP Model

To ensure the effective implementation of the integration standard framework of the CCCP

model, a comprehensive implementation guarantee mechanism needs to be constructed from three aspects: platform technology, quality supervision, and collaborative linkage. In terms of platform technology guarantee, the credit bank needs to add exclusive functional modules for the CCCP model, including an achievement entry module that supports one-click upload and batch import of course scores, certificate information, competition awards, and practice records. The intelligent conversion module automatically matches the achievement type and conversion rules to generate credit conversion suggestions. The data visualization module displays the accumulation of CCCP achievements and the progress of credit conversion for teachers and students in real time. At the same time, the compatibility of the platform is strengthened, and standardized data interfaces are developed to realize data intercommunication with the institutional teaching management system, enterprise training platform, and competition organization system, so as to solve the problem of achievement data islands. In addition, technical means such as encrypted storage, hierarchical access rights, and operation log tracing need to be adopted to ensure the security of students' personal information and achievement data. In terms of quality supervision guarantee, a "three-level review" mechanism is established. The department level is responsible for the preliminary review of the authenticity of achievements and the integrity of materials, the school level is responsible for the re-review of the matching between achievements and standards, and the expert committee of the credit bank is responsible for the final review of the compliance of credit conversion. Written or electronic review records need to be kept for each level of review. At the same time, the effect of standard implementation is evaluated regularly. Through questionnaires, interviews, and achievement conversion rate analysis, feedback from teachers, students, and enterprises on the framework is collected, and the standards are revised and optimized once a school year to ensure the continuous improvement of the framework quality.

4. Implementation Path of the Integration of the CCCP Model Based on the Credit Bank

4.1 Constructing a "Government-Industry-Enterprise-School" Collaborative Organizational Structure

The integration of the CCCP model based on the credit bank needs to establish a multi-level and cross-subject organizational structure, clarify the rights and responsibilities of each participant, and form a collaborative promotion force. At the top-level decision-making level, a "CCCP Integration Steering Committee" is established, led by the local education administrative department and jointly composed of industry associations, higher vocational colleges in the region, and leading enterprises in fields such as IoT and E-commerce. It is responsible for formulating the overall plan for regional integration implementation, determining the core policies for the connection between the credit bank and the CCCP model, and coordinating to solve the problems of standard unification and resource integration across subjects and institutions.

At the institutional implementation level, a school-level "CCCP Integration Working Group" is established, coordinated by the Academic Affairs Office and jointly composed of the secondary colleges, the Continuing Education College, the Training Center, and the Credit Bank Management Office. It is responsible for the specific implementation of the integration plan. The secondary colleges are responsible for formulating detailed implementation rules in combination with professional characteristics (such as the IoT major focusing on technical certification and the E-commerce major focusing on operational practice). The Credit Bank Management Office is responsible for the entry, review, and credit conversion of achievements. The Training Center connects with enterprise practice posts and competition resources. At the enterprise participation level, special enterprise docking positions are set up. A corporate review team composed of enterprise technical backbones and human resource managers deeply participates in the demand

research of "posts", the standard adaptation of "certificates", and the project design of "competitions". At the same time, it assists institutions in developing practical courses and training projects to ensure that the integration of the CCCP model is closely in line with the actual needs of the industry.

4.2 Constructing a Modular Curriculum System Adapted to the CCCP Model

With the credit bank as the link, the curriculum system is reconstructed according to the logic of "shared at the bottom, separated in the middle, and optional at the top" to realize the in-depth integration of the content of CCCP. The bottom layer sets up a general basic module, covering public basic courses and professional literacy courses, corresponding to the basic credits in the credit bank. At the same time, it incorporates the general knowledge test points of the "1+X" certificate to lay a foundation for the integration of "curriculum and certificate". The middle layer divides the professional core modules and splits the curriculum units according to the post competency map of different majors. The IoT major can be divided into units such as sensor technology, IoT system development, and data operation and maintenance, and the E-commerce major can be divided into units such as e-commerce operation, cross-border e-commerce, and data analysis. Each unit embeds the corresponding core skill requirements of the "1+X" certificate and typical tasks of industry competitions. The unit credits are linked to the certificate level and competition participation qualification. The upper layer sets up an expanded optional module, integrating enterprise post practice courses, emerging technology special courses, and competition training courses. Students can choose independently according to their career plans. The credits of the selected courses, as well as the credits of post practice achievements and competition awards, are all included in the unified management of the credit bank, forming a curriculum closed loop of "learning-practice-competition-certification".

4.3 Establishing a Standardized and Efficient Credit Mutual Recognition and Conversion Mechanism

Relying on the credit bank, a credit mutual recognition and conversion system for the CCCP achievements is built. By clarifying rules, optimizing processes, and making dynamic adjustments, the standardization and flexibility of achievement conversion are ensured. In terms of defining the scope of mutual recognition, the types of achievements included in credit mutual recognition are clarified. The achievements of "curriculum" include the scores of theoretical and practical courses offered by institutions. The achievements of "certificate" cover the "1+X" certificate and industry-authoritative vocational qualification certificates. The achievements of "competition" include awards in national, provincial, and school-level vocational skill competitions. The achievements of "post" include the assessment results of enterprise on-the-job internships and internship internships. All achievements can be included in the scope of mutual recognition only after being reviewed and confirmed by the credit bank. In terms of formulating conversion rules, conversion standards are set according to the type and value gradient of achievements: Curriculum credits are calculated based on class hours and assessment grades, with 18 hours of theoretical courses or 30 hours of practical courses converted into 1 basic credit, and excellent assessment results can be increased by 0.2 credits. The "1+X" certificates are converted into credits by level, with primary certificates worth 1-2 credits, intermediate certificates 2-3 credits, and advanced certificates 3-4 credits, and core certificates can be additionally awarded 0.5-1 credit. Competition achievements are converted into credits based on the competition level and award rank, with national competitions awarding 4-2 credits, provincial competitions 3-1 credits, and school-level competitions 1.5-0.5 credits. Post practice is converted into credits based on the duration and

assessment grade, with on-the-job internships earning 1 credit for every 30 hours, and internship internships awarded 3 credits for excellent performance, 2 credits for good performance, and 1 credit for qualified performance. In terms of optimizing the conversion process, a closed-loop process of "online application - hierarchical review - credit entry" is implemented. Students submit achievement certification materials through the credit bank platform, the department conducts a preliminary review of authenticity, the school conducts a re-review of standard matching, and the credit bank completes the credit conversion after the final review and enters it into the personal account. At the same time, an objection review channel for achievements is set up to ensure the transparency and fairness of the conversion process. In addition, a dynamic adjustment mechanism for conversion rules is established. The conversion standards for various achievements are revised every school year in combination with changes in industry technology and updates in education policies to ensure the timeliness of the credit mutual recognition and conversion mechanism.

5. Conclusion

This study explores the teaching reform of integrating the CCCP model into the IoT major of higher vocational colleges via the credit bank. It clarifies the policy background and practical basis for credit bank-CCCP integration, identifies the IoT major's dilemmas in institutional standards, curriculum, technology platforms, and stakeholder engagement, and proposes an implementation path covering organizational structure, curriculum systems, and credit mutual recognition mechanisms, alongside a tailored standard framework and safeguards. Findings confirm that the credit bank, as a key link between "Curriculum-Certificate-Competition-Post", resolves fragmentation, weak collaboration, and poor adaptability in CCCP integration by unifying achievement standards, optimizing technical support, and integrating multi-stakeholder resources, supporting IoT technical talent cultivation. Future research should address regional IoT major needs to refine integration standards with local industrial traits and explore blockchain for credit bank achievement certification and security, enhancing CCCP integration efficiency and providing targeted models for emerging vocational majors.

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