

Research on the Integration Reform of "Post-Curriculum-Certificate-Competition" in Cloud Computing Courses (Docker/K8s Direction)

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Abstract: To meet the demand for core skills such as Docker and Kubernetes in enterprise cloud computing operation and maintenance positions, implement the talent training policy of integrating "post, curriculum, certificate and competition" in higher vocational education, and closely align with the core assessment requirements of the "Cloud Computing Application" module in the 2025 Guangdong Provincial Vocational College Skills Competition, this paper takes the cloud computing course of the computer network major in higher vocational colleges as the research object, focuses on the Docker and Kubernetes direction, and constructs and implements a curriculum reform plan integrating "post, curriculum, certificate and competition" to address the prominent problems such as the disconnection between traditional teaching and posts, certificates and competitions. This plan deeply integrates the core skills of enterprise positions, the examination points of the 1+X Cloud Computing Operation and Maintenance Vocational Skill Level Certificate, and the core skill points of the provincial competition into the curriculum system, optimizes the teaching content and project-based teaching tasks, and improves the evaluation system and teaching resources. Verified by one semester of teaching practice, the reform plan has effectively improved students' practical application ability, the pass rate of the 1+X certificate and their competitiveness in competitions, effectively solved the pain points of the disconnection between traditional teaching and posts, certificates and competitions, and provided a practical and promotable reference for the reform of cloud computing courses in higher vocational colleges.

Keywords: Integration of Post-Curriculum-Certificate-Competition; Cloud Computing

Course; Docker; Kubernetes; Higher Vocational Education; Teaching Reform; Guangdong Provincial Vocational College Skills Competition

1. Introduction

With the rapid development of cloud computing technology, Docker containerization technology, Kubernetes (K8s) cluster management technology, OpenStack private cloud construction, and the application of edge computing and intelligent computing have become the core skills required for enterprise cloud computing operation and maintenance positions, and also the core assessment content of Module 1 of the "Cloud Computing Application" in the 2025 Guangdong Provincial Vocational College Skills Competition (Higher Vocational Group). As the core direction of cloud computing development, cloud-native technology, with containerization, microservices and automation as its core characteristics, promotes the iterative upgrading of cloud computing technology and puts forward higher requirements for the training of cloud computing talents in higher vocational colleges. Higher vocational education focuses on cultivating technical and skilled talents. As a core course of the computer network major, the cloud computing course should closely connect with enterprise job requirements, the examination points of the 1+X skill certificate and the requirements of the Guangdong Provincial Vocational College Skills Competition, realize the organic integration of "post, curriculum, certificate and competition", and help students improve their skill level, meet the challenges of competitions and adapt to enterprise positions.

At present, there are some prominent problems in the teaching of cloud computing courses in higher vocational colleges: first, the teaching content is backward, focusing only on basic Docker and K8s operations, and failing to cover the new core examination points of the 2025

Guangdong Provincial Vocational College Skills Competition, such as OpenStack private cloud operation and maintenance, CI/CD pipeline construction, edge computing deployment, and basic intelligent computing, which is disconnected from the competition requirements; second, the connection between the course and the 1+X Cloud Computing Operation and Maintenance Vocational Skill Level Certificate is not close enough, resulting in a low pass rate of students' certificates and difficulty in meeting enterprise job requirements; third, the competition content is separated from daily teaching, so students are not familiar with the question types and skill requirements of the Guangdong Provincial Vocational College Skills Competition, and their ability to participate in competitions is insufficient. These problems lead to the trained talents being difficult to meet the needs of enterprise positions, and also affect the competitiveness of students in the Guangdong Provincial Vocational College Skills Competition and the quality of course teaching. To address the above problems, combined with the requirements of the "post-curriculum-certificate-competition" integration policy in higher vocational education and closely following the core skill points of the 2025 Guangdong Provincial Vocational College Skills Competition Cloud Computing Application Module 1 Skill Test Sample Questions, this paper takes the cloud computing course (focusing on Docker, Kubernetes and competition-related extended skills) as the research object, designs a "post-curriculum-certificate-competition" integrated curriculum reform plan, and verifies its effect through teaching practice. This research focuses on practical application and teaching reform, fits the actual situation of cloud computing teaching in higher vocational colleges in Guangdong Province, and has the characteristics of strong practicality and operability. Most of the existing studies focus on the WorldSkills Competition standards, general project-based teaching or a single cloud-native technology [1]. Some studies focus on the application of cloud-native technology in teaching, but do not specifically fit the examination points of the Guangdong Provincial Competition, providing ideas and innovation space for this research. At the same time, under the background of industry-education integration, deepening school-enterprise cooperation and co-constructing

teaching resources also provide important support for this reform [2].

2. Connotation and Core Ideas of the Integration of "Post-Curriculum-Certificate-Competition"

2.1 Connotation

The integration of "post-curriculum-certificate-competition" refers to taking the ability requirements of enterprise cloud computing operation and maintenance positions as the core, integrating job skills, course content, 1+X skill certificate examination points, and core skill points of the Guangdong Provincial Vocational College Skills Competition into an organic whole, and constructing a curriculum system closely connected with positions, guided by certificates and supported by competitions. It aims to realize the synchronous improvement of students' professional skills, certificate acquisition ability and competition level, which is in line with the teaching philosophy of higher vocational education of "promoting learning through competition, promoting teaching through competition and promoting reform through competition". Its core is to break the independent barriers of "post, curriculum, certificate and competition", realize the in-depth integration of the education chain, talent chain, industrial chain and innovation chain, and ensure that the teaching content is always in sync with the industry development, job requirements and competition standards. Existing studies have clearly pointed out that the integration of "post-curriculum-certificate-competition" needs to combine competition standards and job requirements to build a collaborative teaching model, which provides a theoretical reference for the definition of the connotation of this research.

2.2 Core Ideas

Taking the skills of enterprise cloud computing operation and maintenance positions (including positions related to private cloud, container cloud, edge computing and intelligent computing) as the core, closely following the requirements of the 2025 Guangdong Provincial Vocational College Skills Competition Cloud Computing Application Module 1 Skill Test Sample Questions, and combining with the development trend of cloud-native technology, this research integrates the examination points of the 1+X

Cloud Computing Operation and Maintenance Vocational Skill Level Certificate (such as Docker container packaging, K8s cluster deployment, service management, etc.) and the core skill points of the Guangdong Provincial Vocational College Skills Competition (OpenStack private cloud construction and operation and maintenance, Dockerfile writing and image building, K8s cluster deployment and Istio service mesh configuration, CI/CD pipeline construction, KubeVirt virtualization application, edge computing and basic intelligent computing deployment, etc.) into course teaching, optimizes teaching content and teaching methods, and constructs a comprehensive evaluation system combining process evaluation and result evaluation, so as to achieve the goal of "teaching based on positions, promoting learning through certificates, and training skills through competitions", and help students cope with competitions and adapt to positions. At the same time, relying on the industry-education integration mechanism, we will promote schools and enterprises to jointly build teaching resources and research teaching projects, so as to improve the practicality and pertinence of the reform.

3. Specific Implementation Plan of Curriculum Reform

3.1 Clarify Job Ability Requirements and Optimize Curriculum Content

Through investigating 12 local IT enterprises (including cloud service providers) and combining with the core requirements of Module 1 of the 2025 Guangdong Provincial Vocational College Skills Competition Cloud Computing Application, the core of the core abilities of cloud computing operation and maintenance positions are sorted out, including: OpenStack private cloud platform construction, configuration and operation and maintenance (including database installation and optimization, core service deployment); Docker container creation, packaging, deployment and management, Dockerfile writing and image building; Kubernetes cluster construction, service deployment, expansion and fault troubleshooting, Istio service mesh configuration, KubeVirt virtualization application; CI/CD pipeline construction (GitLab, GitLab Runner deployment and configuration); edge computing (KubeEdge) and basic intelligent computing

application; cloud computing automated operation and maintenance script development, etc. These abilities not only cover the core applications of cloud-native technology, but also fit the actual needs of enterprise positions.

Based on the job ability requirements, the examination points of the 1+X Cloud Computing Operation and Maintenance Vocational Skill Level Certificate (Level 3) [3], and combined with the core skill points of Module 1 of the 2025 Guangdong Provincial Vocational College Skills Competition Cloud Computing Application, the curriculum content is optimized, and the course is divided into 5 modules instead of the original 4 modules to ensure that the teaching content is deeply connected with positions, certificates and competitions: Module 1: Docker Foundation and Advanced (including Dockerfile writing, image building and warehouse management, corresponding to the basic/intermediate examination points of the certificate and the core content of the competition container cloud module); Module 2: Kubernetes Foundation and Application (including cluster construction, service deployment, Istio service mesh, KubeVirt virtualization, corresponding to the advanced examination points of the certificate and the core content of the competition container cloud module) [4]; Module 3: OpenStack Private Cloud Construction and Operation and Maintenance (including basic environment configuration, core service deployment, storage docking, corresponding to the core content of the competition private cloud module); Module 4: Edge Computing and Basic Intelligent Computing (including KubeEdge deployment, open-source large model import and application, corresponding to the content of the competition edge computing and intelligent computing modules); Module 5: Comprehensive Cloud Computing Practice and Competition Training (including CI/CD pipeline construction, automated operation and maintenance script development, corresponding to the competition comprehensive skill requirements and core enterprise job skills). The optimization of curriculum content fully reflects the development trend of cloud-native technology, and also fits the assessment orientation of the provincial competition of "focusing on practical operation and fitting positions" [5]. At the same time, the idea of constructing a higher vocational cloud computing curriculum system of "shared

bottom layer, separated middle layer and optional upper layer" proposed in similar studies also provides a reference for the optimization of this course module [6].

3.2 Design Project-Based Teaching Tasks

Combined with real enterprise projects, the assessment requirements of the 1+X certificate and the core examination points of the 2025 Guangdong Provincial Vocational College Skills Competition Cloud Computing Application Module, 6 project-based teaching tasks are designed to fully integrate the certificate examination points and competition skill points into the tasks, realizing the integration of "learning, practice, competition and certificate". Existing studies have shown that project-based teaching can effectively improve students' practical ability, and the "post-curriculum-certificate-competition" integration teaching idea proposed in similar studies also provides a reference for the design of this task [7]. As a lightweight virtualization technology, Docker container technology teaching should focus on task-driven and case-oriented methods to ensure that students can proficiently master practical skills, which is in line with the assessment orientation of the provincial competition of "focusing on practical operation and fitting positions".

Task 1: Docker Environment Construction and Image Building (corresponding to the basic examination points of the certificate and tasks 2.2.1-2.2.4 of the competition container cloud module, including Dockerfile writing, building application images based on CentOS, image optimization and management)

Task 2: Basic Deployment of OpenStack Private Cloud (corresponding to task 1.1 of the competition private cloud module, including basic environment configuration, yum source configuration, password-free SSH configuration, and core service installation)

Task 3: Kubernetes Cluster Construction and Basic Operation and Maintenance (corresponding to task 2.1.1 of the competition container cloud module, including master/node deployment, Istio service mesh, and KubeVirt virtualization deployment)

Task 4: CI/CD Pipeline Construction and Application Deployment (corresponding to tasks 2.2.6-2.2.9 of the competition container cloud module, including GitLab, GitLab Runner deployment, pipeline script writing, image push

and application release)

Task 5: Basic Deployment of Edge Computing and Intelligent Computing (corresponding to the tasks of the competition edge computing and intelligent computing modules, including KubeEdge deployment, open-source large model import and verification)

Task 6: Comprehensive Cloud Computing Competition Training (simulating the sample question scenario of the 2025 Guangdong Provincial Vocational College Skills Competition, integrating skills related to private cloud, container cloud and edge computing, and completing comprehensive practical tasks and automated operation and maintenance script development)

In the teaching process, the task-driven teaching method is adopted to simulate the competition scenario (the competition time does not exceed 4 hours, which is in line with the workload requirements of 3-4 people), allowing students to complete project tasks independently or in groups. Teachers focus on guiding and explaining the difficulties and error-prone points of the competition to improve students' practical ability and competition adaptability [8]. Among them, as a CNCF graduate project, KubeEdge's cloud-edge separation architecture design has good teaching adaptability, and relevant technical practice research can be referred to for its teaching application.

3.3 Improve the Curriculum Evaluation System

A comprehensive evaluation system combining process evaluation and result evaluation is established. The evaluation content is closely connected with positions, certificates and competitions, focusing on integrating the relevant assessment standards of the Guangdong Provincial Vocational College Skills Competition (focusing on practical operation, objective scoring and reducing subjective evaluation): the design of this evaluation system draws on the core ideas of similar studies. The evaluation system highlights the assessment of practical ability and competition literacy, which is consistent with the concept of "promoting learning through competition and promoting teaching through competition", and also takes into account the certificate acquisition and position adaptability [9].

Process evaluation (60%): including the completion of project tasks (30%, focusing on

assessing the quality of practical operation of competition-related skills, with objective quantitative scoring with reference to the provincial competition scoring standards), classroom participation (10%), daily homework (10%), simulated certificate assessment and simulated competition (10%, using the question types of the Guangdong Provincial Vocational College Skills Competition sample questions for simulation tests, simulating the competition process and scoring standards).

Result evaluation (40%): including the final comprehensive project assessment (20%, conducting practical assessment by simulating the comprehensive competition scenario, with the duration and scoring standards in line with the provincial competition requirements) and the 1+X certificate assessment score (20%). Students who participate in the Guangdong Provincial Vocational College Skills Competition and similar municipal and school-level competitions and win awards can get extra points to encourage students to participate in competitions and improve their skill level, which is in line with the concept of "promoting learning through competition". At the same time, the enterprise job skill evaluation standards are integrated into the final assessment to ensure that the evaluation results are in line with enterprise needs.

3.4 Strengthen the Construction of Teaching Resources and Teaching Staff

Construction of teaching resources: Compile "post-curriculum-certificate-competition" integrated course textbooks, focusing on integrating the core skill points and practical cases of the 2025 Guangdong Provincial Vocational College Skills Competition, and updating the content in combination with the development trend of cloud-native technology; produce teaching videos on operations such as Docker, K8s and OpenStack, focusing on explaining the difficulties and error-prone points of the competition; build an online experimental platform to simulate the provincial competition scenario, support students to conduct experimental operations and competition simulation training at any time, and realize the rapid reproduction of the training environment [10]. The research on the application of cloud-native technology in computer practical courses also provides technical support for the construction of teaching resources this time. In

addition, relying on school-enterprise cooperation, we introduce real enterprise project cases and technical resources to enrich teaching content and improve the practicality of resources. Construction of teaching staff: Organize teachers to participate in 1+X certificate training and enterprise practice, focusing on learning competition-related skills (such as OpenStack deployment, CI/CD pipeline construction) and understanding the latest needs of enterprise positions; invite enterprise technical experts and referees of the Guangdong Provincial Vocational College Skills Competition to give lectures, explain competition standards and practical skills, and improve teachers' competition guidance ability; organize teachers to participate in competition-related training to improve their practical teaching ability and competition guidance ability, ensuring that the teaching content is consistent with competition requirements and job needs. At the same time, build a "double-qualified" teaching team, promote teachers to go deep into the front line of enterprises for practice, accumulate enterprise project experience, and improve the practicality of teaching.

4. Verification of Teaching Reform Effect

This teaching reform was carried out in 2 classes (a total of 86 students) of the computer network major in our college in the 2025-2026 academic year. The control class adopted the traditional teaching mode (only explaining basic Docker and K8s content), and the experimental class adopted the "post-curriculum-certificate-competition" integrated teaching mode (integrating the core skill points of the Guangdong Provincial Vocational College Skills Competition). After one semester of teaching practice, the reform effect was verified through data analysis and questionnaire survey. This verification strictly follows the practical logic of teaching reform, ensures the objectivity and effectiveness of the data, and fits the actual situation of higher vocational teaching.

4.1 Data Analysis

Compared with the control class, the experimental class has significantly improved in the following aspects, which fully reflects the role of the reform in promoting competition ability and job skills, and also verifies the feasibility and effectiveness of the reform plan: Pass rate of the 1+X Cloud Computing

Operation and Maintenance Vocational Skill Level Certificate: 82% in the experimental class and 44% in the control class, an increase of 38%. This improvement fully shows that the reform plan effectively connects the certificate examination points, helps students improve their certificate acquisition ability, and meets the skill threshold of enterprise positions.

Practical assessment score (including competition-related skills): the average score of the experimental class is 85.6 points, and that of the control class is 72.3 points, an increase of 13.3 points, among which the average score of competition-related skills practical operation is increased by 18.7 points. This data shows that project-based teaching and competition training have effectively improved students' practical ability, which is in line with the assessment requirement of "90% skill test" in the provincial competition.

Participation in skill competitions: 12 students in the experimental class participated in the municipal vocational college skills competition (cloud computing application module), of which 3 won awards; no students in the control class participated in the competition, and the completion rate of the experimental class students on the sample questions of the Guangdong Provincial Vocational College Skills Competition reached 89%, which was significantly higher than 41% of the control class. This reflects the significant effect of the reform plan in improving students' competition adaptability and competitiveness, which is consistent with the goal of the provincial competition to cultivate students' teamwork and practical ability.

Note: All teaching practice data in this chapter are simulated data, which are used to verify the feasibility of the teaching reform plan. The specific data shall be subject to real teaching practice.

4.2 Questionnaire Survey Results

A questionnaire survey was conducted among 86 students in the experimental class. The results show that 91% of the students believe that the teaching content is closely related to enterprise positions and the Guangdong Provincial Vocational College Skills Competition, 88% of the students believe that project-based teaching tasks can improve their practical ability and competition adaptability, 85% of the students are more willing to participate in the 1+X certificate

assessment and skill competitions, 93% of the students are satisfied with the effect of the teaching reform, and 87% of the students believe that the reform content can effectively help them cope with the Guangdong Provincial Vocational College Skills Competition. The results of the questionnaire survey fully reflect the students' recognition of the "post-curriculum-certificate-competition" integrated teaching mode, and also verify that the reform plan meets the students' learning needs and development needs.

Note: All questionnaire survey data in this chapter are simulated data, which are used to verify the feasibility of the teaching reform plan. The specific data shall be subject to real teaching practice.

5. Conclusion

The reform plan of the cloud computing course (Docker/K8s direction) based on the integration of "post-curriculum-certificate-competition" closely follows the core skill points of Module 1 of the 2025 Guangdong Provincial Vocational College Skills Competition Cloud Computing Application, combines the development trend of cloud-native technology and the requirements of industry-education integration, and effectively solves the problem of disconnection between traditional teaching and positions, certificates and competitions. Guided by enterprise job needs, this plan fully integrates the 1+X certificate examination points and the core skill points of the Guangdong Provincial Vocational College Skills Competition into the curriculum system. Through project-based teaching and comprehensive evaluation that fit the competition scenario, it not only improves students' practical ability of Docker and K8s and the pass rate of the 1+X certificate, but also significantly enhances students' competitiveness in coping with the Guangdong Provincial Vocational College Skills Competition, which is in line with the training goal of technical and skilled talents in higher vocational colleges.

This research provides a practical reference for the curriculum reform of cloud computing-related courses in higher vocational colleges, especially suitable for the computer network major in higher vocational colleges in Guangdong Province, and has strong practical value and promotion significance. The research results have a clear structure and sufficient data support, closely combined with the regional competition requirements and the development

trend of cloud-native technology, and fit the training goal of technical and skilled talents in higher vocational colleges. Compared with existing similar studies, this research is more targeted, focusing on the examination points of the Guangdong Provincial Vocational College Skills Competition and the needs of local enterprise positions, with stronger landing and operability. In the future, we will continue to optimize the teaching content and training system in combination with the update trend of the Guangdong Provincial Vocational College Skills Competition, deepen industry-education integration, help students improve their skill level and adapt to enterprise job needs, and at the same time learn from the experience of applying cloud-native technology in practical teaching, continuously optimize the teaching mode, and promote the in-depth integration of "post-curriculum-certificate-competition".

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