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Research on Hybrid Teaching Driven by Big Data Application Development Competition

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Abstract: With the increasing emphasis placed by the country on vocational education, it has become a key focus for vocational colleges to encourage their students to participate in national vocational skills competitions, through which they can enhance their professional qualities, theoretical knowledge, practical skills, and employability. The big data technology major of Jiangsu Maritime Institute has analyzed the knowledge and skill points required in big data application development skills competitions, and has constructed a project-driven hybrid teaching approach based on the Chaoxing Cloud Course Platform, which utilizes a SPOC (Small Private Online Course) approach. By aligning with the workflows and tasks of big data technology-related job positions, the major integrates skills competition projects into its curriculum, realizing a learner-centered, integrated online and offline learning approach. Through teaching practice, this teaching method has achieved good results, improving the quality of teaching and students' learning enthusiasm, and providing new methods and perspectives for the reform of big data technology professional courses in higher vocational education.

Keywords: Big Data Technology Major, Skills Competition, Course Resources, Position-Course-Competition-Certification.

1. Introduction

The national vocational skills competition, as a publicly-organized and nationwide vocational skills competition, is initiated by the Ministry of Education and jointly organized with relevant departments of the State Council, industries, and social organizations. This competition has demonstrated significant effects in promoting the quality of technical and skilled talent cultivation, verifying teaching achievements, and leading educational and teaching reforms [1-2]. At the same time, it plays a positive role in deepening the implementation of the comprehensive educational model integrating jobs, courses, competitions, and certifications. The Big Data Application Development competition item is aimed at thoroughly implementing the national big data strategy and actively responding to the requirements of the State Council's "Outline for Promoting the Development of Big Data" and the 2021 Government Work Report on accelerating digital development, promoting new forms of digital economy, facilitating the digitization of industries, and transforming industries through digitization, with a commitment to building a complete multi-level and multi-type big data talent cultivation system. Closely aligned with the technical needs of the big data industry, this competition item aims to enable participants to fully experience all aspects of big data projects through competition, thereby testing teaching quality, leading and promoting vocational education and teaching reforms, ensuring that education keeps pace with the latest international standards, and fostering a social atmosphere that values skills. It aims to stimulate students' autonomous learning and problem-solving abilities, achieving the goals of promoting learning through competitions, assisting teaching through competitions, and driving reforms through competitions.

The employment directions for students in the big data technology major in higher vocational education are diverse, mainly covering core positions such as data collection and processing, big data implementation and operation and maintenance, big data analysis and visualization, and big data platform management [3-4]. These positions require students to have a solid foundation in big data technology, possess the abilities of data collection, cleaning, processing, and analysis, and be familiar with the deployment, implementation, and operation and maintenance management of big data platforms. Through professional learning and practice, students can competently play key roles in big data projects, providing strong support for enterprises' data-driven decision-making. This major not only offers students broad employment prospects but also cultivates high-quality big data technology talents that are urgently needed by society, contributing to the vigorous development of the digital economy.

To promote teachers to change their teaching methods, the big data technology major of Jiangsu Maritime Institute has deeply integrated the competition items, competition processes, and technical specifications of the Big Data Application Development competition item in the higher vocational group of the National Vocational Skills Competition into classroom teaching, further enhancing students' interest in learning and skill levels, and improving their ability to apply what they have learned. The major regards award-winning contestants in skills competitions as learning models, upholds the virtues of high moral standards and excellent skills, improves the quality of professional teaching and students' employability, and boosts the rapid development of the major.

2. Talent Cultivation System Construction Based on "Position-Course-Competition-Certification" Integration

The "Position-Course-Competition-Certification" integration aims to achieve an seamless integration between job requirements, course content, skill competitions, and professional qualification certificates [5]. Through this model, students can closely align their learning with actual job positions, participate in skill competitions to enhance practical abilities, and obtain professional qualification

certificates, laying a solid foundation for future employment. This integration model not only improves the pertinence and effectiveness of vocational education but also promotes the comprehensive enhancement of students' overall qualities, providing strong support for cultivating high-quality skilled talents that meet market demands. It is an effective way to promote the high-quality development of vocational education. In recent years, numerous higher vocational institutions in China have actively explored and practiced the " Position-Course-Competition-Certification" integration teaching mode, achieving remarkable results. As a typical example, Jinhua Polytechnic has deeply integrated job competency requirements, vocational skills competition standards, and professional qualification certificate requirements to build a systematic curriculum system, form a structured teaching faculty, and develop new forms of textbooks, effectively improving teaching quality [6]. Shenzhen Polytechnic integrates Huawei's skill standard system and vocational college skills competition norms into its curriculum standards, clarifying specific requirements for students in terms of knowledge, abilities, and qualities, achieving "Position-Course-Competition-Certification" integration in the context of industry-education integration, providing a referential example for similar institutions [7].

Deeply implementing the concept of vocational education, the big data technology major promotes the integration of industry and education, aligning with the national professional teaching standards for vocational education, vocational skill level standards, "1+X" certificate standards, and the national vocational college skills competition regulations. Adhering to the principles of "promoting teaching, learning, reform, and construction through competitions," and guided by student employment, it constructs a talent cultivation system integrating " Position-Course-Competition-Certification" as shown in Figure 1.

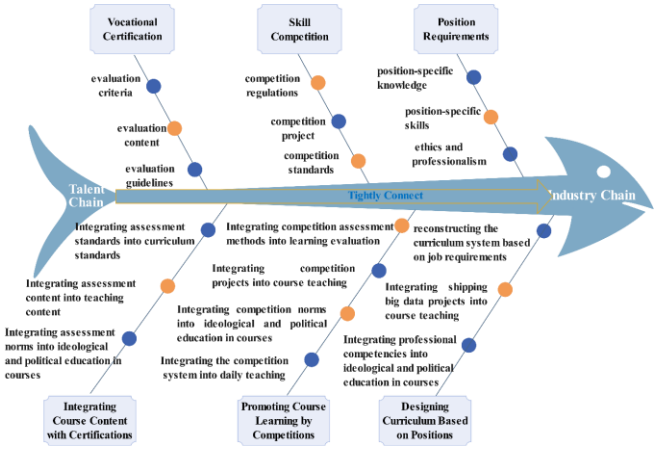

Fig. 1 The talent cultivation system based on "Position-Course-Competition-Certification" integration

For the competition regulations of the Big Data Application Development contest in vocational college skills competitions, the key assessment points of the competition are broken down and mapped to the teaching knowledge points and practical skill training points in the curriculum. Based on a thorough analysis of job characteristics and competition patterns, the skill competition assessment points are "assigned to courses," allowing courses to "undertake" these points. Targeted reforms are implemented, and assessment standards are clearly defined, forming a new set of curriculum standards that are applied to course teaching. This achieves a state where attending classes and practical training is equivalent to preparing for the competition, eliminating courses and practical training that do not align with job requirements.

3. Hybrid Teaching Based on Spoc and Skill Competition Projects

3.1. Competition-driven approach

Hybrid teaching methods have significantly enhanced students' learning motivation and effectiveness. However, in practical implementation, several challenges remain, such as the incomplete functionality of course website platforms, the relative scarcity of online teaching resources, and the inadequacy of teaching project selections [8]. Notably, the widespread promotion of skill competitions in vocational colleges has not only driven the innovation of skilled talent cultivation models but also become an efficient way to improve education quality. In this context, the careful selection and design of projects have become crucial aspects of project-based teaching, requiring that the selected projects not only align with students' interests and ability levels but also simulate real-world work environments as closely as possible. Skill competition projects, due to their challenging nature, alignment with student ability levels, closeness to real-world scenarios, and ability to update with technological advancements, are regarded as valuable teaching resources. Therefore, integrating skill competition elements into vocational education curriculum reforms is of great significance for enhancing course teaching effectiveness, improving students' professional job capabilities, and promoting professional development [9].

Alongside the pace of high-level professional group construction in big data technology and applications in Jiangsu Province, the big data technology major, as the core of this professional group, is embarking on the construction of a new round of core professional courses. The core concept of this curriculum construction revolves around the SPOC (Small Private Online Course) hybrid teaching framework, skillfully integrating skill competitions, project-based teaching, and the reform of skilled talent cultivation models, aiming to create a learner-centered, deeply integrated online-offline learning mode.

3.2. Resource preparation

The big data application development project is based on projects such as take-out data analysis and enterprise consumption service platform data analysis, covering steps such as data platform construction, data collection, data cleaning, data analysis, and data visualization. As projects integrated into professional teaching, skill competition projects involve multiple courses in the major. The big data platform construction and collection module are applied in the "Big Data Platform Deployment and Maintenance" course, the data collection and data cleaning modules are applied in the "Data Warehouse" course, the data cleaning and data analysis modules are applied in the "Big Data Analysis and Development" course, and the data visualization module is applied in the "Data Visualization Technology" course. Skill competition projects, as projects integrated into professional teaching, are decomposed into individual learning tasks. The data analysis module is decomposed into two tasks for application in the "Big Data Analysis and Development"

course. The first task is data cleaning, which is divided into two sub-tasks. The first sub-task is to clean attribute columns in the original data set that do not conform to business logic, addressing data conflicts caused by multiple data sources and multiple data collections. The second sub-task is to fill in missing numerical fields in the data set using methods such as the median and KNN (K-Nearest Neighbors), considering the characteristics of the industry data itself and the considerations.

The teaching environment setup is divided into online and offline parts. The online part includes the release of course information, announcements, various resources, and online tests on the SPOC platform, while the offline part mainly involves the setup of laboratory hardware and software environments. Skill competition projects utilize a virtual machine environment requiring four machines: three for the big data platform and one for development, which is completed on students' own laptops. The laboratory is set up with the same environment, and the development machine is completed on students' own laptops. The design of teaching activities under hybrid teaching mainly involves the reasonable arrangement of online and offline teaching activities. Online activities mainly involve shallow learning, including watching micro-videos, completing online tests, and participating in online discussions. Offline classrooms focus on deep learning, driven by project tasks. For example, in the "Big Data Platform Deployment and Maintenance" course module 2, task 1 of big data platform basic preparation involves the platform's operating environment. Students need to watch five videos online on basic configuration, network configuration, and Java environment configuration, and complete 10 online test questions. In the classroom, the teacher first guides students to discuss how to implement basic platform setup, then instructs them to complete the setup step-by-step, with the teacher responsible for answering questions.

3.3. Teaching practice

In the teaching process, tools such as Learning Tong, online simulation platforms, and big data training platforms are utilized to facilitate continuous online and offline learning, fostering students' autonomous learning abilities. A dual-mentor system involving both school and enterprise mentors is implemented to ensure that students not only establish a solid knowledge foundation but also acquire practical skills. By developing both on-campus and off-campus training bases, students can gain exposure to real-world positions and cultivate practical work capabilities. Students are encouraged to collaborate in group projects and actively participate in flipped classrooms to enhance their critical thinking skills. Multiple measures are taken to help students grasp key points and overcome difficulties. Integrating ideological and political elements into the curriculum ensures that both professional skills and professional ethics are improved simultaneously.

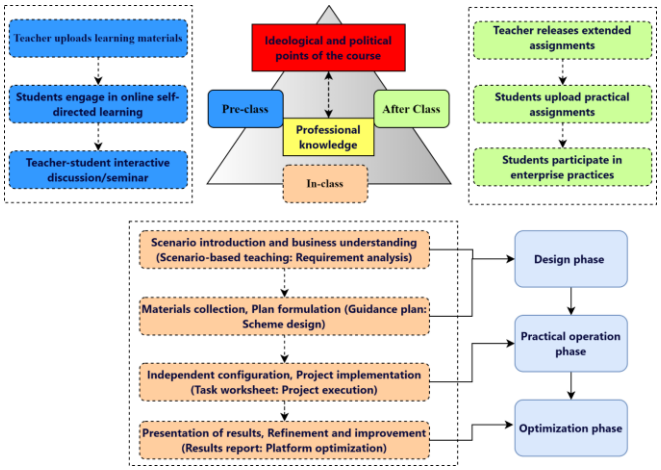

Fig. 2 The teaching strategies based on blended learning

3.4. Learning evaluation

A diverse range of assessment mechanisms is employed to objectively, fairly, and comprehensively evaluate students' learning status, which helps to enhance students' learning enthusiasm, improve their academic performance, and increase their confidence and determination in pursuing big data technology careers.

Based on the characteristics of the Big Data Technology major, a teaching assessment method that combines online and offline evaluations, involves multiple evaluation subjects, and emphasizes process-oriented evaluations and practical assessments is adopted. The core courses in the major are evaluated through both process evaluations and comprehensive evaluations. Process evaluations encompass daily performance, regular assessments, and project assessments. Taking the "Big Data Platform Deployment and Operations" course as an example, the proportions of each component in the evaluation are shown in Table 1.

Table 1 The evaluation and assessment table

Assessment Name		Assessment Content	Proportion
Process Evaluation	Daily Performance (Online + Offline)	Evaluated based on classroom attendance, Q&A participation, online resource utilization, and discussion contributions.	10%
	Regular Assessment (Online + Offline)	Evaluated based on the quality of assignments and test completions	10%
	Practical Project 1	Deployment and Operation of Hadoop HA	9%
	Practical Project 2	Construction of an Online Food Delivery Layered Data Warehouse Based on Hive	9%
	Practical Project 3	Execution of Online Food Delivery Data Analysis Programs Based on Spark	12%
Comprehensive Evaluation	Project Design	Evaluated through the submission of project reports and oral defenses (operation of the takeout data analysis platform and navigation data analysis platform)	20%
	Comprehensive Assessment	Final exam	25%
Overall Evaluation		Process Evaluation (70%) + Comprehensive Project Design Evaluation (30%)	100%

3.5. Teaching effectiveness

Compared to traditional teaching, which employs a monotonous evaluation strategy primarily consisting of regular grades and final exam scores, the enhanced blended learning approach that integrates SPOC (Small Private Online Course) platforms and skills competition projects adopts diverse assessment methods. This allows for a more precise measurement of students' knowledge levels and professional competencies, significantly stimulating their enthusiasm for learning. To compare the impact of these two teaching modes on educational outcomes, the final exam scores of two classes were used for comparison. After undergoing different teaching methods, the final exam scores for the course "Big Data Platform Deployment and Maintenance" for both the experimental class and the regular class are presented in Table 2. The table clearly shows that the average final exam score of the experimental class is significantly higher than that of the regular class, indicating that the hybrid teaching mode based on SPOC platforms and skills competition projects can markedly improve students' academic performance in professional courses. In contrast to traditional teaching methods, this hybrid teaching approach is highly effective.

Table 2 The comparison of scores in Big Data Platform Deployment and Maintenance

Index / Class	Average Score		Standard Deviation	Highest Score	Lowest Score
Regular Class	65.42		6.38	92	41
Experimental Class	80.93		12.30	100	32

The introduction of skills competition projects into the teaching process of the "Big Data Platform Deployment and Maintenance" course has enhanced students' practical abilities and professional competencies. In the experimental class, the proportion of students who were able to complete all practical projects and project designs reached 73%, whereas in the different class, it was only 43%. The practical modules were the main reason for the widening gap between the two classes. Conducting skills competition projects driven by the SPOC platform can stimulate students' learning enthusiasm and more effectively cultivate core skills in software development.

4. Conclusion

This paper explores the application of skill competition project-driven teaching conducted through the SPOC platform based on Chaoxing Cloud Course Platform in the professional courses of big data technology in higher vocational education. The aim is to facilitate students' transition from passive to active learners, strengthen the cultivation of core skills, and thereby enhance their ability to explore independently, better serving the goal of cultivating professionals in the field of big data technology. At the same time, this teaching mode also promotes the transformation of teachers' roles, shifting them from traditional lecturers to instructors who integrate lecturing with technology and take a leading role.

The rapid development of information technology and changes in the student population of higher vocational education mean that reforms in the teaching of big data technology professional courses are never-ending. Teachers need to continuously reflect on and improve their teaching activities to meet the requirements of hybrid teaching modes. This includes considering how to better adapt students to the integrated online and offline teaching methods, how to make online resources more aligned with job standards and skill competition requirements, and how to enhance students' enthusiasm and initiative in learning through blended teaching and flipped classrooms.

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