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Research and Practice on the Integrative Teaching Model of "Post-Course-Competition-Certificate-Research" for Big Data Technology Major

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Abstract: *Addressing issues such as the mismatch between teaching content and job requirements, incompatibility between teaching methods and student learning conditions, and the incongruity between teacher qualifications and industrial development, we have adopted an approach based on the OBE (Outcome-Based Education) concept. Leveraging an innovative platform, our big data major takes real corporate projects as the main thread and student autonomy and innovation as the driving force. This ensures that the five elements of job positions, courses, competitions, certificates, and research complement each other, achieving an effective alignment between innovative talent cultivation and industrial talent demand. Through this construction practice, the quality of talent training in the big data major has been comprehensively improved, and teachers' scientific research capabilities have been fully enhanced. This approach serves as a leading example for cultivating innovative applied technical talents in big data and other IT industries.*

Keywords: *Vocational education, Big Data Major, Industry-Education Integration, Integration of Research and Education, Skills Competition*

1. Introduction

The big data industry is a national strategic emerging industry and a high-tech pillar industry that Jiangsu Province and the Yangtze River Delta region prioritize for development [1]. This industry is characterized by the frequent emergence of new technologies and new positions, making it challenging for talent cultivation to keep pace with industrial development demands. The field of big data technology is rapidly evolving, with new tools, techniques, and methodologies emerging constantly [2]. The integration of big data technology with traditional industries also gives rise to diverse job requirements. However, the rapid technological advancements and changing job needs have created a significant gap between teaching content and actual job requirements [3-4]. With a diverse student population and varying educational needs in vocational colleges, teachers' teaching philosophies are still rooted in traditional education models. The singular teaching approach can no longer meet students' individualized needs. The high-quality development of the big data industry demands higher professional knowledge and skills from teachers. Yet, teachers' practical abilities are insufficient to meet the requirements of project-based teaching reforms under the integration of industry and education as well as the integration of science and technology.

To address the mismatches between teaching content and job requirements, teaching methods and students' learning conditions, and teachers' qualifications and industrial development, the big data technology major adopts an approach based on the OBE (Outcome-Based Education) concept. Leveraging an innovative platform, this approach takes real corporate projects as the mainstay and is driven by students' independent innovation. It integrates the five elements of job positions, courses, competitions, certificates, and research, achieving effective alignment between innovative talent cultivation and industrial talent demand.

2. Construction Practice

Based on the OBE concept, relying on an innovative platform, and taking real corporate projects as the mainstay, driven by students' independent innovation, the five elements of job positions, courses, competitions, certificates, and research are integrated to achieve effective alignment between innovative

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talent cultivation and industrial talent demand.

Course originated from post: By aligning with the job requirements of platform operation and maintenance engineers, data processing engineers, and other positions, real industry project cases are introduced and integrated into the main professional courses. These cases serve as a common teaching carrier to organically link the core courses, forming a project-based curriculum system oriented towards job skills. Research integrated in course: Injecting cutting-edge knowledge through scientific research, introducing research methodologies to improve students' problem-solving abilities, and optimizing talent cultivation models, curriculum system construction, and teaching model innovation through teaching and research. Course promoted by competition: Leveraging the advantages of skill competitions in connecting with new technologies and skills, competition achievements are transformed into teaching resources. Methods such as competition training and integration of competition and teaching provide learning channels for students to obtain professional skill certificates. Course validated by certificate: Using certificates as a test of learning outcomes, the study for certification exams serves as a supplement, reinforcement, and improvement to course learning, which is reflected in the integration of course content and certificate exams.

2.1. Build the Curriculum System Integrateing "Post-Course-Competition-Certificate-Research" by Closely Connecting with the Industry

Relying on the Huawei ICT Academy and targeting small internet companies, IT outsourcing enterprises, and other units, the big data industry chain is aligned to clarify the job requirements for platform operation and maintenance engineers, data processing engineers, and other positions. Basic job skills and workflows are used to determine the professional foundation and core courses. By integrating big data technology and application competitions, 1+X certificates, Huawei HCIA-BD and other certificates, as well as various scientific research projects of teachers into the curriculum, constructed a curriculum system that integrates " Post-Course-Competition-Certificate-Research" as shown in Figure 1 is built. This curriculum system generates courses from jobs, integrates research into courses, promotes courses through competitions, and validates courses through certificates.

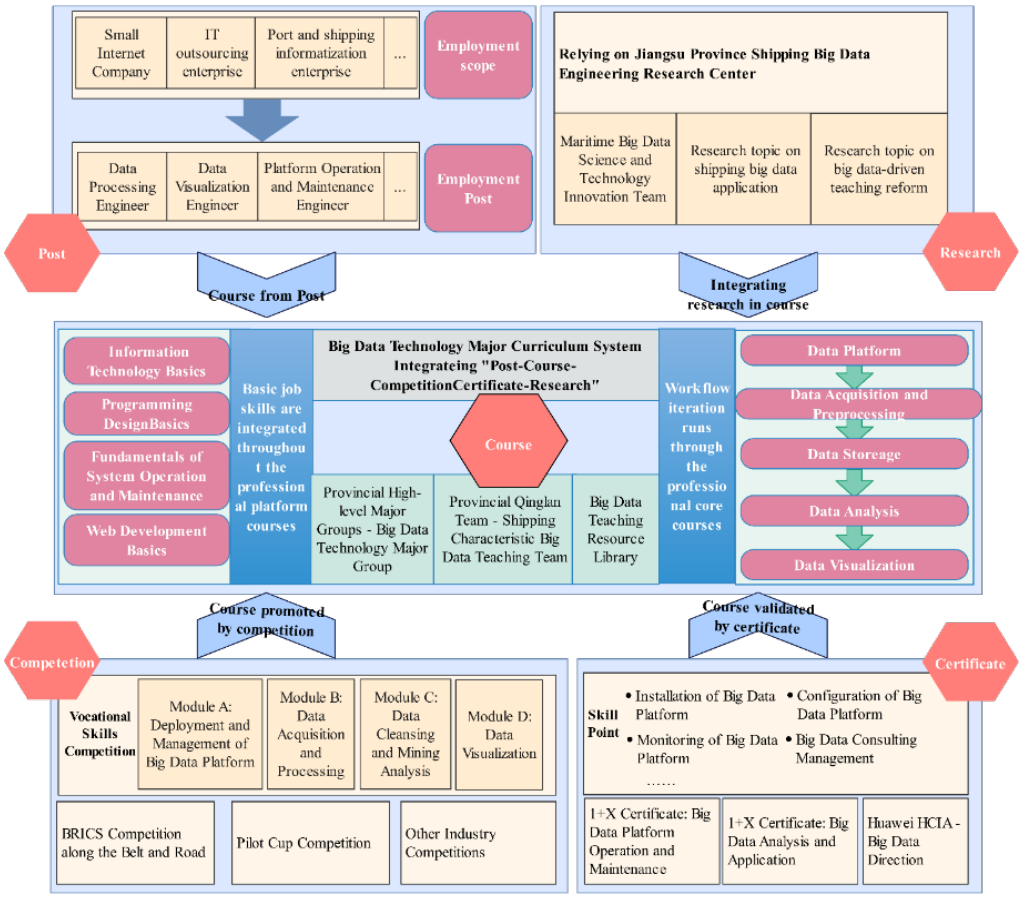

Figure 1: The curriculum system

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The "post-centered curriculum" refers to a dynamic adjustment mechanism in production that closely connects with industries and timely adjusts curriculum settings and content based on actual job requirements [5]. The "research-integrated curriculum" refers to integrating new technologies and methods applied by teachers in shipping big data application research into classroom teaching. The "competition-enhanced curriculum" refers to integrating competition training methods with daily teaching methods, integrating competition evaluation criteria with teaching evaluation criteria, and integrating professional ethics and professionalism throughout the classroom teaching process. The "certificate-verified curriculum" refers to assessing, replacing, and converting relevant course scores with vocational skill level certificates and vocational qualification certificates.

2.2. Innovate the Project-based Teaching Model of "Progressive Layers and Full-process Penetration"

Based on Huawei ICT Academy, a Ship Intelligent Management and Control System used in Jiangsu Maritime Safety Administration is transformed into a main practical project for ship data analysis system that runs through the entire process of big data talent training. According to the progressive requirements of "basic skills, special skills, and compound skills," a three-level progressive practical teaching system is designed. To adapt to the current situation of large differences in students' practical abilities, practical training project contents at three levels of basic, intermediate, and advanced are developed to meet the needs of students at different levels, as shown in Figure 2. The team deeply explores the ideological and political elements inherent in the main course project, constructs a curriculum ideological and political package with maritime power as the axis and maritime characteristics and innovation, aiming to cultivate technical and skilled talents with "patriotic feelings, craftsmanship, and marine genes."

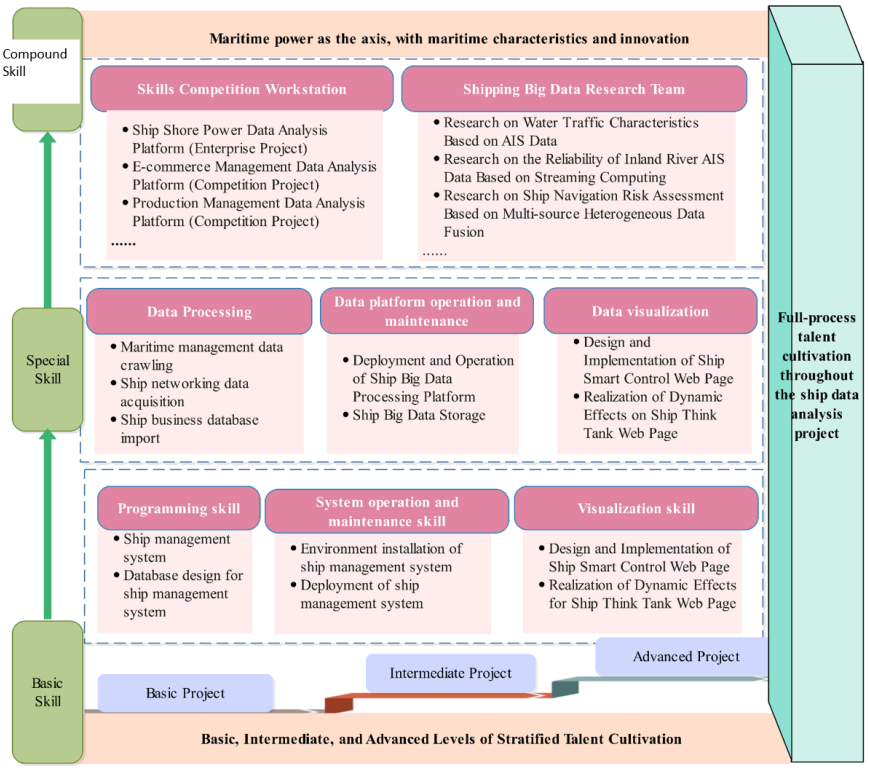

Figure 2: The project-based teaching model

2.3. Insist on collaborative innovation and build a big data teaching team with distinct shipping characteristics

As shown in Figure 3, relying on platforms such as the school-level collaborative innovation center and provincial engineering centers, a big data teaching team with distinct characteristics that can undertake shipping knowledge embedding, shipping project integration, and nautical spirit integration through collaborative innovation is built. The team dispatched several teachers to practice as concurrent posts in enterprises such as Nanjing Huihai to deeply grasp big data technology while mastering shipping business and knowledge; through the construction of big data skills competition workstations, deeply

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grasp the industry standards and development trends of big data technology, and constantly summarize competition training methods and apply them to teaching; integrate the research results of shipping big data field applications into the classroom, supporting high-quality talent training with high-level scientific research. Through the integration of industry, education, research, and competition, and integrating shipping characteristics, a high-quality teacher team with high technical level and strong teaching ability is formed to solve the problem of mismatch between teacher literacy and the development needs of the big data industry.

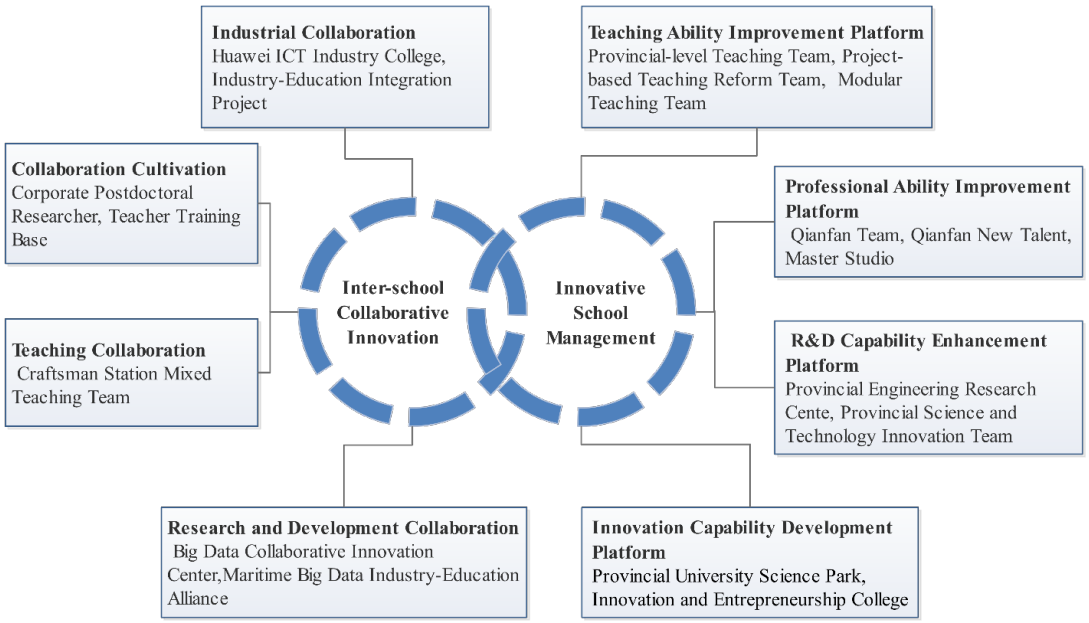

Figure 3: Construction of Big Data Teaching Team

3. Experience Summary

3.1. The educational philosophy centered on student learning and development requires the integration of post, course, competition, certificate, and research

By integrating certificate standards, systematizing work processes, and designing contextualized courses, we aim to align course content with professional standards and the teaching process with the production process through the "introduction of positions into courses." This involves collecting typical work tasks for various positions, categorizing them based on their ability attributes, and integrating student ability development with industrial needs, project research and development, competition-driven learning, and exploratory learning. The focus is on industry application, project implementation, competition motivation, and continuous exploration. Given the rapid changes in the big data industry, we rely on the Huawei ICT Academy and port and shipping information enterprises to constantly update technical regulations. The school adjusts course settings and content in a timely manner, forming a dynamic adjustment mechanism of "stimulus-response-regulation" both inside and outside the school, achieving seamless integration between positions and courses. With students as the center, we maximize student benefits by presenting the characteristics of the curriculum system, analyzing its advantages, elucidating the benefits students can gain, and persuading them with evidence.

3.2. An ability-oriented approach demands a project-based teaching model with "differentiated training and layered teaching."

Considering the current situation in higher vocational education, we introduce the positional ability requirements of small internet companies and port and shipping information enterprises to optimize the practical teaching system based on main projects. We systematically develop projects at three levels: "basic projects, advanced projects, and extended projects," aligning with the three stages of ability requirements: "basic positional skills, specific positional skills, and composite skills." This satisfies the "three-stage, three-level" training project library for "different learning tasks at different stages and different difficulty levels at the same stage." The teaching implementation designs the teaching process

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through engineering process orientation, achieving "learning by doing and doing by learning" and cultivating students' professional abilities in a simulated real work environment. In the process of completing projects, students not only need to comprehensively apply professional knowledge and hone their operational skills but also cultivate their abilities to learn independently, think innovatively, work in unity and cooperation, bear pressure, and take responsibility [6].

3.3. The construction of the teaching team is the guarantee for the integration of positions, courses, competitions, certificates, and research.

Leveraging the "melting pot" role of the Huawei ICT Academy, we collaborate with small internet companies and port and shipping information enterprises to build an integrated teaching team for industry, education, and research. Through teacher exchanges, internships, corporate research, and training in port and shipping information enterprises, continuous forging in the "melting pot" of enterprises ensures resonance with the industry. Through the integration of industry, education, and research, every teacher in the profession has scientific research topics and teaching reform projects. This enhances their technological innovation and practical teaching abilities, achieving "scientific research empowerment." The teaching team uses vocational college skill competitions as a starting point, organically integrating skill competitions with team building. Research is conducted around competition training and evaluation methods, innovating course teaching methods and comprehensively improving the overall level of professional teachers. The teaching team also aligns with vocational qualification certificates, using certificate requirements as a basis to achieve curriculum standards alignment with certificates and promote coordinated development between teaching and talent cultivation. Through the "integration of industry, education, and research, and the mutual promotion of competitions, certificates, and education," a distinctive teaching team with a clear shipping characteristic is gradually formed, which "understands shipping business knowledge, knows data development technology, and is capable of researching smart shipping."

4. Conclusion

The integration of “Post-Course-Competition-Certificate-Research” in big data technology major requires collaboration between teachers and students for mutual creation, symbiosis, and growth. This benefits all students in the major, leading to comprehensive improvements in talent cultivation quality and the overall enhancement of teachers' research capabilities. Through this integration, the big data technology and application professional group has become a high-level professional group in Jiangsu Province, and a subproject of the national big data teaching resource database has been established. As a result, 17 teaching research papers have been published, enriching the educational theory of the integration of job positions, courses, competitions, certificates, and research, as well as OBE+ project-based learning. Students have won 2 first prizes in the big data category of skill competitions at the national level. Additionally, the provincial Qinglan Project teaching team, provincial teaching masters, provincial talent projects, provincial teachers' teaching ability competitions, provincial innovation projects, provincial key textbooks, provincial excellent graduation designs, provincial teaching and research projects, provincial teaching and research achievements, and internationalization have all achieved remarkable results.

Acknowledgements

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