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Research on the Curriculum Reform of Exploration on "Water Conservancy Engineering Construction" under the Guidance of Industry-University-Research

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Abstract: *The essence of industry-university-research is close cooperation between schools and enterprises, promoting learning through industry and nurturing industry through research. How to cultivate composite talents that meet the employment standards of enterprises in the new era has become the problem. This article starts with the current situation of industry-university-research in various universities, and analyzes the ways and methods of integrating industry-university-research. By analyzing the teaching process of the compulsory course "Water Conservancy Engineering Construction" for the major of water conservancy and hydropower engineering, the existing problems of the course are analyzed from three aspects: curriculum system and teaching content, training mechanism and faculty, teaching ideology and performance evaluation. The purpose of industry-university-research is further clarified, and a curriculum reform method that is consistent with the needs of the times and deepens the integration of industry-university-research is proposed, in order to implement the plan to promote professional talent cultivation as soon as possible, Building a distinctive path with water conservancy characteristics.*

Keywords: *Industry-university-research; Water conservancy engineering construction; Double teacher system; Intelligence and Ecology*

1. Introduction

Industry-university-research refer to policies led by the government to focus on user centered technological innovation. While enterprises seek new ways of development, they promote the cultivation of high-quality talents in universities, and research institutions utilize their achievements to promote the development of industry enterprises. Form the core teaching philosophy of "production oriented, teaching as the path, and student centered".

The Yellow River Water Conservancy Vocational and Technical College utilizes the Henan Provincial Satellite Remote Sensing Application Sub Center of the school to provide services such as navigation and location, unmanned aerial vehicle intelligent surveying and mapping, helping to shine the "Yellow River Eye" and providing scientific and technological innovation support for the precise governance, development, and management of the Yellow River by the Ministry of Water Resources and the Yellow River Committee. Under the background of new liberal arts, the insurance major of Hebei University of Finance has built a talent training mode of "co-construction, co-management, sharing", built a diversified collaborative innovation mechanism, and made multi subject collaborative innovation [1]. Innovate the concept of collaborative education among universities in the Guangdong-Hong Kong-Macao Greater Bay Area, improve the mechanism of collaborative education, create a platform for sharing resources in industry-university-research, and deepen collaborative cooperation [2]. Nanchang University of Aeronautics and Astronautics has established a three-level industry university research cooperation platform for the Metal Materials Engineering major, carried out three types of scientific research cooperation, and developed five support mechanisms for efficient operation [3]. Jiangsu Ocean University actively builds a platform for school enterprise cooperation, sharing research and development innovation, increasing investment in industry university research cooperation through multiple channels, and improving the conversion rate of scientific and technological achievements in various aspects [4]. Tsinghua University has proposed the development of industry-university-research cooperation as a benchmark discipline, integrating the originally scattered cooperation between teachers and enterprises into a comprehensive cooperation between schools and enterprises [5]. It also

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actively explores key technologies common to the industry, and promotes interdisciplinary research cooperation and school enterprise technology cooperation to drive teacher capital construction. Northwest A&F University of Science and Technology has established a three-level agricultural technology demonstration base network, established an agricultural technology expert courtyard model, summarized different forms of agricultural information consultation and training, and formed a positive interactive mechanism for scientific and technological cooperation between the university and the enterprise, promoting the close integration of industry-university-research [6]. Southeast University has established a social service concept with the aim of "the government is the most concerned, enterprises are the most needed, and the people are the most welcome", and has embarked on an effective path of industry university research cooperation with the characteristics of Southeast University [7]. Taiyuan University of Technology has deepened the reform of the training mode and built a multi-dimensional professional degree graduate education quality management system supported by industry, university, research and application from the aspects of the training concept, mode, platform, tutor team, training process management and evaluation of professional degree graduates [8]. This article starts with the necessity of offering courses in water conservancy engineering construction, analyzes existing problems, and proposes a curriculum reform plan that combines ecological and intelligent integration with industry and education, in order to solve the problem of curriculum emphasizing theory while neglecting practice and insufficient cutting-edge technology.

2. Necessity of course offering

The engineering and supporting projects built to achieve flood control, waterlogging control, irrigation, power generation, water supply, and other purposes are collectively referred to as hydraulic engineering. The main task of hydraulic engineering is to "promote water conservancy and eliminate water hazards". How to scientifically construct water conservancy projects is the starting point of the problem, and how to make the construction of water conservancy projects develop together with the times is the extension of the problem. It is also the eternal self question of every scholar related to water conservancy construction. Water Conservancy Engineering Construction is a professional course closely combining theory and practice. This course includes construction water flow control, blasting engineering, foundation treatment engineering, earth rock dam engineering, concrete dam engineering, underground structure engineering, general construction organization, construction management, etc. The course content covers classic cases and construction experience of water conservancy engineering construction both domestically and internationally. Starting from construction machinery, construction technology, and construction organization and management, it combines the three major controls, two major management, and one coordination to study the methods and methods of constructing water conservancy engineering in a fast, efficient, and cost-effective manner. After systematically studying water conservancy engineering construction, students should have basic knowledge of water conservancy engineering construction and be able to preliminarily engage in construction organization design and management. Students have already learned the types of hydraulic engineering and construction methods under different dam types during the process of studying hydraulic structures, completing a preliminary understanding of hydraulic engineering construction and laying the foundation for studying this course. The solid and rigorous theoretical foundation and strong practical construction feasibility of the course "Water Conservancy Engineering Construction" mean that it plays an indispensable role in the field of water conservancy and hydropower engineering, serving as a bridge for students to transition from theoretical knowledge to practical engineering operations. Therefore, it is set as a compulsory core course for students in this major.

3. Analysis of Existing Problems in Curriculum and Exploration of Reform Methods

In the current teaching of the course "Water Conservancy Engineering Construction", the evaluation of grades consists of three parts: regular attendance in class, submission of homework after class, and final exam scores. At the same time, there is also a water conservancy engineering construction course design, which students need to complete and submit within the specified time to obtain credits for the course design. The course is taught by a single teacher, and the entire process is theoretical teaching. The exam method is a closed book exam. Industry-university-research "is an innovative collaborative system engineering that involves systematic cooperation in production, learning, scientific research, and practical application. It is the connection and coupling of technological innovation upstream, midstream, downstream, and innovation environment with end users. It is another deepening of the integration of industry-university-research in both understanding and practice. Studying this course not

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only lays a solid foundation for students to build water conservancy and hydropower projects in the future, but also lays the foundation for the integration of water conservancy engineering construction with modernization. In the teaching process, it is not difficult to find that there is still a considerable distance between the current curriculum status and the requirements of industry-university-research. Below, this article will analyze the problems from three aspects: curriculum system and teaching content, training mechanism and teaching staff, teaching ideology and performance evaluation, and propose reform methods for reference and exploration.

1) Curriculum system and teaching content. The course system of water conservancy engineering construction is based on the curriculum concept of "absorbing advanced domestic and foreign experience, researching how to construct water conservancy and hydropower engineering more quickly, efficiently, and economically", and the curriculum goal is to cultivate students who understand design, construction, budgeting, management, and dare to innovate. The course structure is composed of five parts: "Based on the characteristics of water conservancy engineering construction, focusing on the basic principles of construction procedures, construction plans, construction methods, and construction organization management of various individual projects and representative hydraulic structures in water conservancy and hydropower hubs", and the course activity mode of "in class interaction+examination+course design". The teaching content consists of seven parts: construction water flow control, blasting engineering, foundation engineering, earth rock dam, concrete dam engineering, underground structure engineering, and general construction organization, among which three parts: construction water flow control, earth rock dam and concrete dam engineering are mainly taught, accounting for 66.7% of the total class hours. There are a lot of knowledge points in the construction of water conservancy projects. There is a long time interval between the compilation of teaching materials, publication and students' learning and use, so that some knowledge has been disconnected from production practice when students systematically learn. Especially when it comes to concrete construction, there is an important part involved, which is temperature control and crack prevention methods for large volume concrete. Due to class time limitations, the depth of this part of the content is far from enough, which can easily lead to students having a partial understanding after learning, often knowing it but not knowing its reason. If the textbook is accompanied by a book specifically explaining practical engineering cases, it can help students have more understanding. As the core course of the water conservancy and hydropower engineering major, the allocation of water conservancy and hydropower engineering construction class hours should be more appropriate, the explanation of the core content of the course should be strengthened, difficult and important knowledge points should be amplified, and divided into several classes for students to digest and absorb. At the same time, it weakens a portion of the content that is currently rare in engineering applications and lists it as a part that students can understand, making the course explanation more prioritized.

Academician Wang Hao proposed that intelligence is an important symbol of the high-quality development of water conservancy in the new era, and the main task of smart water conservancy construction is to upgrade the "eye, brain, hand, and pulse". The deep integration of industry-university-research is the internal driving force for promoting the upgrading of water conservancy intelligence. The current curriculum can only make progress through continuous innovation and reform. The combination of water conservancy engineering construction with smart water conservancy technologies such as digital twin technology, water networking, GNSS remote sensing technology, and BIM technology has become a course that truly cultivates "industry university research" talents. Environmental pollution, ecological destruction, geological disasters and species diversity are all happening with the large-scale construction of water conservancy projects. How to protect the ecological environment and minimize the impact on nature while building water conservancy projects requires the combination of water conservancy projects and ecological water conservancy. Update the content of the textbook, optimize the layout and structure of the textbook, add intelligent and ecological content, so that students not only have an understanding of traditional experiences, but also systematically learn and recognize new knowledge.

2) Training mechanism and teaching staff. From the perspective of the training mechanism, there are still shortcomings in the current student training mechanism. A course closely integrated with industry-university-research should meet the following aspects: with the goal of improving the quality of undergraduate education, relying on selected personnel from enterprises to provide lectures, creating a new atmosphere for collaborative cultivation of undergraduate students, creating a "dual teacher system" training mode, stimulating undergraduate students' subjective initiative, increasing their depth of thinking, and cultivating their independent innovation ability. The current curriculum teaching is still based on a single teacher system, where one teacher takes on the teaching task. This teaching mode has many problems, such as students inevitably losing interest when studying for a long time under a single

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teaching mode. The dual teacher system refers to a course that is taught by one teacher both on and off campus. On campus teachers are responsible for explaining theoretical knowledge teaching, while off campus teachers are responsible for explaining examples, boundary and applicability in practical applications, and demonstrating and explaining cutting-edge software operations. The dual teacher system requires at least two teachers to prepare lessons in advance, which greatly tests the knowledge reserve and collaborative ability of the teacher team. This means that the curriculum will be refined and refined, and students will complete the initial combination of theory and practice in their learning.

The teaching ratio of higher education in China is significant, and the teaching tasks of teachers are heavy, which limits their ability to innovate and practice. At the same time, teachers spend a long time conducting scientific research in schools and lack opportunities for practical training in enterprises, resulting in a dilemma of only focusing on theoretical aspects and being trapped in a closed door approach. To break through the dilemma, it is necessary to combine "bringing in" and "going out" to expand the scale of the teaching staff. The combination of "bringing in" and "going out" refers to bringing engineers who have mature work experience in enterprises and have been working on the front line for years to teach in schools, and bringing teachers who are proficient in theoretical research to enterprises, injecting fresh blood into schools and enterprises. Due to the strong practicality of the course of water conservancy engineering construction, the introduction of off campus teachers not only represents the introduction of more practical engineering experience, but also represents the determination and will to cultivate more outstanding students and find a new path that closely integrates social production practice with school teaching and research after deeply understanding the needs of society and enterprises.

3) Teaching philosophy and performance evaluation. Currently, classroom teaching is mainly based on the cramming teaching method of "teachers speaking on stage and students listening off stage". Students have not yet become the core of the classroom and only serve as listeners to receive knowledge during the learning process. The quality of teaching largely depends on the high or low level of students' acceptance ability. Production oriented, teaching as the path, and student centered "is the core teaching concept of the combination of industry-university-research. Through multimedia teaching, flipped classrooms, and example explanations with off campus enterprises, students' learning enthusiasm is enhanced, and passive learning is transformed into actively absorbing knowledge from the outside world.

The most commonly used method of evaluating students in domestic universities is still the exam system. Although there is a certain proportion of regular grades, the final exam results still determine whether a student's academic performance is excellent or not. Although the examination system can quantitatively evaluate students' learning level to a certain extent, it has a fundamental drawback, that is, it can also achieve good grades through temporary cramming. It is not difficult to find that the temporary effort of cramming is not directly proportional to the reward of high scores. Instead, students who study hard but have poor exam taking abilities are difficult to be recognized in the exam system environment, and ultimately the exam does not achieve the goal of assessing students' learning. In the new era, especially in the context of industry-university-research, learning is multidimensional and multi thinking. Basic theoretical knowledge, applied practical knowledge, and cutting-edge technology knowledge are all inseparable parts of the curriculum learning process. That's why the grading standards should be diversified. The composition of grades for water conservancy engineering construction should be changed to 10% for regular class attendance, 20% for homework submission, 30% for flipped classroom grading, 20% for cutting-edge software operation, and 20% for final exam grading. Compared to the current exam system dominated by final exams, the new composition of grades has significantly reversed the dilemma of "one exam determines life and death", encouraging students to not be confined to the classroom, Simultaneously improving students' practical operation and explanation abilities, helping to cultivate composite application oriented talents in the new era.

Water conservancy engineering construction is a course with strong theoretical and practical significance. The course design of water conservancy engineering construction is the main practical method currently used in schools, but there are still certain problems that need to be solved. On the one hand, the course design time for water conservancy engineering construction is slightly short and needs to be appropriately extended. The purpose of extension is to make students less eager to submit course designs, allowing them more time to digest course learning content and improve the details of course design. On the other hand, the selection of course design materials is outdated, and consideration should be given to adding actual cases that have been completed by relying on enterprises. Create an atmosphere of "industry demand oriented, combined with industry development, and integrated with industry characteristics" through case studies. Under the guidance of teachers, deepen students'

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impression of the book knowledge they have learned, and promote students to develop the habit of actively thinking and solving practical problems. One of the key points of teaching reform should be to increase the weight of practice, add outdoor internships to the learning of water conservancy engineering construction courses, and jointly select internship locations by schools and supporting enterprises. At the same time, the internship results should be regarded as one of the final grades of water conservancy engineering construction courses, in order to achieve multi-dimensional evaluation of students' learning level.

4. Conclusion

Industry-university-research should be regarded as a whole, with a dual nature of academic and industrial nature. Currently, many domestic universities have achieved considerable success in the field of industry-university-research, and have embarked on a path with school style. But there is still a long way to go to meet the new requirements of industry-university-research, and coordination and cooperation from multiple parties are needed. The course "Water Conservancy Engineering Construction" plays a connecting role in the field of water conservancy and hydropower engineering, and is one of the typical courses in this major. Starting from this course, we will conduct a deep analysis of the existing problems and reform ideas under the cooperation of industry-university-research from three aspects: "curriculum system and teaching content", "training mechanism and teaching staff", and "teaching ideology and performance evaluation". To change the current situation, it is necessary to increase course format, change grading methods, and add new learning paths. The purpose of education and teaching reform is for professional talents to learn professional knowledge and quickly transform it into practical production experience, as well as to achieve the goal of "industry-university-research". The curriculum reform under the guidance of industry-university-research not only requires schools to leverage their professional expertise and establish deeper cooperative relationships with enterprises, but also requires schools to actively integrate resources, lay a solid foundation for deepening industry-university-research, and walk out of the school's unique path.

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