

Mini Review

Research on the Connotation Development of Civil Engineering Materials Courses in Universities of Applied Sciences, a High Level in China

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Abstract

German universities of applied sciences have provided a large number of technical talents to society, and have made significant contributions to the enhancement of German education and industry. Drawing on the professional construction experience of German universities of applied sciences, this paper summarizes the path of civil engineering materials courses in China's high-level applied universities. The proposals for curriculum reform were discussed. Colleges and universities can cultivate professionals with strong hands-on abilities, strong exploration abilities, and a scientific research spirit. In addition, this paper puts forward that China needs to make changes from three levels: the country, universities, and teachers. Based on learning from the experience of collaborative education between teaching and scientific research in German universities, we have embarked on a road of education with China characteristics.

Germany's "Vocational Education 4.0" plan focuses on using the Internet platform of the manufacturing industry to compete for the commanding heights of innovative production around the underlying technologies, standards, and intellectual property rights of intelligent manufacturing [1]. With the popularization of China's higher education and the advent of the fourth industrial revolution driven by intelligence, China's education and industry fields have promoted the birth and development of application-oriented universities. How to build high-level applied technology universities with Chinese characteristics is a key issue of this era as universities need to cultivate more high-level applied talents in order to solve the imbalance between the supply and demand of talent [2].

The background of the construction and development of China's application-oriented universities

With the introduction of a series of national strategic documents such as "Made in China 2025", many technological changes have promoted the emergence of new industries and the development of new formats, which has set off a

wave of the fourth industrial revolution. A new type of higher education institution with engineering technology was established by the German government in 1967, as well as pilot schools in some states. In the winter semester of 2019-2020, there were 2,897,300 registered students in Germany, of which 35.5% chose universities of applied sciences. The development trend of German universities of applied sciences is stable and improving, and they have successfully occupied the core position of the higher education system and become an important driving force for Germany's economic and social development. Germany's "Vocational Education 4.0" plan mainly focuses on "Industry 4.0" as the core of reform, focusing on the manufacturing Internet platforms to compete for the commanding heights of innovative productivity around the underlying technologies, standards, and intellectual property rights of intelligent manufacturing [3]. To assist the smooth implementation of this strategy, it is necessary to conduct theoretical research on the connotative development of China's high-level applied technology universities, especially the courses that combine theory and practice such as civil engineering materials and how to balance the overall

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theoretical teaching, experiment, and practical operation of the course is one of the urgent problems to be solved in China's high-level applied science universities [4].

Secondly, the problems existing in the civil engineering materials course and the integration of industry and education. The combination of theory and practice at the University of Applied Sciences has become an indispensable part of talent training because of the problems present in civil engineering materials courses and the integration of industry and education. There are some problems in the course of civil engineering materials, such as short teaching time, and other courses crowding out theoretical teaching time, resulting in a serious shortage of teaching time [5]. To re-plan the teaching content of civil engineering materials, it is necessary to ensure that the course content meets the vocational qualification standards for materials positions in the field of civil engineering and construction, as well as the knowledge, ability, quality requirements, and students' cognitive rules required for career development, and on the other hand, to carry out classroom teaching design based on real work tasks, so as to form a high-quality undergraduate vocational education course that integrates systematic learning fields and project-based theory and practice [5]. The "double synergy" training mechanism of the integration of industry and education stimulates the endogenous power of enterprise participation through collaborative innovation so that collaborative innovation and collaborative education are organically combined. It not only breaks through the bottleneck of the combination of theory and practice in civil engineering materials, but also improves the practical ability and talent quality of middle school students in applied science universities, and provides new ideas for the high-quality development of local applied universities [6]. In line with the needs of industry enterprises, the school carries out "axis flipping" for the teaching of courses such as civil engineering materials, and flips the curriculum system and teaching methods with the cultivation of applied innovation ability as the guide. Promote and form a number of industry-education integration courses with advanced teaching concepts and high teaching levels [7]. Under the guidance of the "integration of industry and education" mechanism, the school can better play the role of teaching and educating people, so that college students can better absorb civil engineering materials and other courses, and cultivate a group of talents with strong application technology and ability to combine theory with practice. The school can also better discover and understand the needs of the enterprise industry, and provide enterprises with talents who combine theory and practice.

Connotative development

From the point of view of teaching management at universities of applied sciences, civil engineering materials have similar credits to other theoretical courses: Hours, assessment requirements, etc. However, from the perspective

of practical talent training, the teaching requirements of civil engineering materials have undergone significant changes, and it is difficult to meet the teaching requirements of courses such as the combination of practice and theory by copying the teaching standards of other theoretical courses, so it should be adjusted according to the actual needs. Courses such as civil engineering materials must pay attention to the situation of students, highlighting the main position of students and the guiding role of teachers, and advocate heuristic and open teaching. In the teaching process, combined with other theoretical courses and enterprise application needs, based on the characteristics of students' cognitive and ability structure, a problem situation is created that is conducive to student's independent learning and practice [8].

The German experience and the development of education in China

In the mid-1960s, the federal states, represented by Baden-Württemberg and Berlin, and the German National Academic Council (Wissenschaftsrat) began to discuss the construction scheme of Gesamthochschule and carried out the Y-shaped training mode, in which the first half completed the basic stage of study together, and the second half could choose the development route of professional application or academic research [9-12].

With the acceleration of the process of education opening to the outside world, the Chinese gradually have an accurate and clear understanding of the German University of Applied Sciences. The University of Applied Sciences lays more emphasis on application and practice orientation [13-16].

Firstly, teachers in applied science universities must have professional qualifications and practical experience in enterprises. Professors should have many years of working experience in enterprises in addition to doctoral degrees.

Secondly, professional practice or training experience is one of the necessary conditions for students to enter school.

Thirdly, practice should be regarded as a part of the training program, such as the practice semester.

Fourthly, the student groups are more diverse, aiming at reducing employment discrimination and social injustice.

Fifth, the specialty setting is closely related to the local economy, serving the development of the regional economy and industry, and has strong regional attributes.

Bielefeld University of Applied Sciences started at the earliest, with a large scale and a high level of development among German universities of applied sciences. Taking this university as an example, it is both representative and typical to explore the talent training practice of German universities of applied sciences, in order to gain useful practices and experiences in developing vocational education at the undergraduate level in China.



1. A clear concept of running a school

It is mentioned in the teaching mission statement of Bielefeld University of Applied Sciences that the teaching and learning of Bielefeld University of Applied Sciences are based on the common values of all members and staff of the university, and its focus is on the unity of teaching and scientific research, the combination of scientific and clear applied purposes, and the promotion of democracy, diversity, internationality, and respectful cooperation.

2. Comprehensive training objectives

As for the training goal of students, the core concern of Bielefeld University of Applied Sciences is that students acquire ability and knowledge in a "comprehensive and rooted base". As important as solid subject knowledge and method ability is the development of a student's personality: "Independent and reflective actions characterized by social ability are the characteristics of graduates of Bielefeld University of Applied Sciences, who should actively and responsibly adapt to the complex changes and development of society and be able to use digital technology."

3. Reasonable professional setting

Bielefeld University of Applied Sciences was formed by the integration of a number of colleges and universities at the beginning of its establishment. Its purpose is to develop into a "cradle of professional and applied talents". Talent training is mainly oriented to vocational employment, and the characteristics of strong specialty setting and application are very prominent.

4. Clear curriculum system

Similar to most universities of applied sciences in Germany, the curriculum system of Bielefeld University of Applied Sciences is also designed as modular courses. According to the modular curriculum design idea, it is clear about the content structure of the major and is also helpful to adapt to the adjustment of the major setting.

5. Flexible learning mode

The dual learning mode is one of the necessary attributes of the German University of Applied Sciences, and the successful mode of Bielefeld University of Applied Sciences on the Guetersloh campus is a practical comprehensive specialty.

Returning to the national conditions of China and the learning situation of universities, this paper puts forward that China needs to make changes from three levels [17-20]: the state, universities, and teachers. That is, the country should be tangible and standardized, pay attention to policy guidance, and broaden the boundaries of collaborative education. The country should implement performance orientation and reform the sources of funds.

Universities advocate adapting measures to local conditions and promoting school-enterprise cooperation to educate people. Universities should reject glitz and attach importance to the quality of personnel training.

Teachers should be powerful and promising, reform the teaching mode, and realize the cooperation of science and education in educating people.

Therefore, on the basis of learning from the experience of collaborative education between teaching and scientific research in German universities, we have embarked on a road of education with China characteristics [21-25].

Conclusion

The combination of industry and education has been promoted and applied in recent years due to the constant prominence of the social service function of colleges and universities. Drawing on the professional construction experience of German universities of applied sciences, it is necessary for the connotative development of the curriculum of Chinese universities of applied sciences to summarize and reform the courses that combine theory and practice. A series of constructive curriculum reform plans of the University of Applied Sciences are discussed through the analysis of the problems existing in civil engineering materials and the integration of industry and education.

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