

Research on the Mode and Countermeasures of Industrial College Construction in Local Undergraduate Universities Based on the Integration of Industry and Education

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Abstract: The construction of industrial college is an important way to deepen the integration of industry and education, and a beneficial exploration of the training mode of applied talents. The construction of industrial college in colleges and universities from the perspective of the integration of industry and education is the performance of the technical talents needed to adapt to the industrial development actively, and it is the continuous exploration of economic development from scale expansion to high-quality development. However, there are still some problems in the implementation of this education model. This paper discusses the connotation, organizational characteristics and mode of industrial college, and puts forward countermeasures and suggestions from the aspects of structure, mechanism and concept, so as to provide reference for local colleges and universities to solve the problem of integration of industry and education.

Keywords Integration of industry and education; Local undergraduate universities; Industrial college

INTRODUCTION

Since the concept of "integration of industry and education" was first put forward in the Decision of The State Council on Accelerating the Development of Modern Vocational Education in 2014, deepening the integration of industry and education has been regarded as a strategic measure to promote education priority, talent-led development, industrial innovation and high-quality economic development [Duan and Bi, 2021]. The integration of industry and education is not only conducive to introducing market forces into colleges and universities so as to promote the construction of colleges and universities to keep pace with The Times, but also conducive to improving students' understanding of professional knowledge and making them more in line with the needs of market high-tech talents [Wang, 2021].

The integration of industry and education is one of the key difficulties in the development of higher education, and the development of industrial colleges provides an effective way to deepen the integration of industry and education [Zhang, 2021]. The industrial school interprets the knowledge hidden in the textbook, puts students in a specific situation, and promotes the digestion of professional knowledge and the all-round development of personal literacy. The highly fluid talent market and talent "hunting" have an immeasurable impact on enterprises. In addition, the educational talents in colleges and universities cannot fully meet the needs of enterprises, which gives rise to the emergence of industrial colleges and gives play to the function of talent reserve [Nie, 2020]. Traditional teaching is confined to book teaching and classroom teaching, while the emergence of industrial college

solves the limitations and conditions of class teaching to a certain extent [Yang, et al., 2021].

In August 2020, the Ministry of Education and the Ministry of Industry and Information Technology launched the Guide to the Construction of Modern Industrial College (Trial), giving detailed guidance on the guiding ideology, curriculum setting, training mode and other aspects of industrial college, and clearly proposing to train a group of talents suitable for the industry in a certain direction, guided by the talent needs of local economic development. Local colleges and universities shoulder important responsibilities in industrial enterprise gathering, industrial structure upgrading, regional economic development needs and regional application-oriented talents in short supply [Zhou and Wu, 2021]. This paper introduces the concept and organizational characteristics of industrial colleges, explores for reference experience by comparing the construction mode of industrial colleges in international countries, and on the basis of this, puts forward some countermeasures and suggestions for the construction strategy of industrial colleges in local undergraduate universities.

THE CONCEPT AND ORGANIZATIONAL CHARACTERISTICS OF INDUSTRIAL COLLEGE

Industrial college, as a new organizational form of deepening the integration of industry and education, is a manifestation of the transformation from government-sponsored teaching to multi-social participation in running schools. It deeply integrates universities and enterprises, takes resource sharing and social progress as the basic goals, and takes industrial resources and educational knowledge as the

carrier. The essence of the integration of industry and education is the integration of industry and education training, teaching in the reality of industry, industry in teaching, industry and teaching are inseparable. On the one hand, industrial college infuses the industry base, process technology, industrial resources, work experience, management culture and other factors into the knowledge imparting process of colleges and universities, and combines with the resources of colleges and universities to meet the talents needs of enterprises and the transformation and upgrading development. On the other hand, by taking charge of teaching system construction, industry maintenance, personnel training, information exchange, professional experience, scientific research and other work, relying on the industrial resources owned by the enterprise to improve the professional ability and quality of graduates. Different from the general school-enterprise cooperative teaching mode, industrial college is a teaching institution jointly organized by universities and local industry quality enterprises with a sound independent operation mechanism. It does not directly belong to universities, nor is it short-term training of enterprises. It promotes the reform of talent market while retaining the organizational characteristics of colleges and universities.

Industrial college has the following organizational characteristics: First, school-enterprise cooperative education. The president of the industrial college is elected from the board of directors composed of school-enterprise representatives to manage all aspects of the industrial college in a unified way and make up for the deficiencies in the system of public colleges by introducing market forces. Second, cooperation and sharing of diverse resources. The Industrial College integrates local universities and industrial enterprises into the same community of interests. It has the government finance, supporting infrastructure policy support, college teachers and industrial resources and management mode of enterprises, and effectively integrates the characteristic resources of all parties. Third, the object of service is clear and clear. Compared with traditional secondary colleges, industrial colleges have clear industrial service objects and specific industrial groups, and their curriculum, teaching content, professional system and teaching mode are closely related to the development of real industries.

THE CONSTRUCTION MODE AND EXPERIENCE OF INTERNATIONAL INDUSTRIAL COLLEGE

Throughout the world's experience, there are three basic models of the integration of industry and education: Singapore's "teaching factory" model, Japan's "industry, education and government" model and Germany's "dual system" model.

Singapore's "teaching factory" model

Singapore has always attached great importance to the education of applied technology, most notably the "teaching factory" model of Nanyang Polytechnic in Singapore. Influenced by the "liberal" economic theory of the early industrial Revolution, this model emphasizes the concept of "unbounded" organization, introduces the industry process of enterprise industrial chain into the classroom, and tries to break the boundary between schools and enterprises, disciplines and majors in the teaching process. The government has a special guidance agency to provide financial support and legal protection for teaching factories.

The boundary between different markets is an important factor restricting the integration of industry and education. The "teaching factory" model in Singapore advocates unbounded collaboration, unbounded course teaching and unbounded platform management, and students can participate in practical training with real environment without leaving school. The company sends experienced managers to teach with school teachers, leading students to understand the latest cutting-edge technology and industrial industry line process, into the actual industry operation; By building a teaching experiment platform, students can directly enter the practical operation link after teaching and learning, which solves the problem of students' practical implementation of textbook knowledge, and also greatly reduces the training cycle and cost for enterprises' post-recruitment training.

Talent cultivation cannot be separated from the leadership of excellent teachers. Under the "teaching factory" model of Singapore, schools achieve large-scale cultivation by running schools independently, aim at resource sharing and deep integration, eliminate the boundaries of different markets, and attach importance to the construction of teachers and the cultivation of students' practical ability and innovative consciousness. This model has formed a benign incentive mechanism, which is not only supported by academic qualifications, but also supports work ability and performance in the promotion. In the recruitment process, industry elites are introduced based on the work experience in the industry, and teachers' further education and training are emphasized to improve the teaching level and ensure that students become application-oriented talents.

Japan's "industry, education and government" model

In the so-called "industry-university-government" model, "industry" refers to the industrial group represented by various industries and investment subjects in the market, "university" refers to the educational institutions represented by schools, and "government" refers to the government institutions providing policy support and guidance for industry-

university cooperation. The government gradually occupies a dominant position in this educational mode. The government gives different policy support to different cooperation modes. For example, the funds for the start-up activities of enterprises and schools can be deducted from the corporate tax. We will encourage universities to transfer their research and development technology to the industrial sector, stimulate students' innovative vitality, and fully demonstrate the ability of schools and enterprises to participate in and serve the overall development of society.

Cooperation between schools and enterprises is not limited to a certain form. Joint research, signing contracts, setting up joint research centers, donation system and other important forms of "industry, education and government" cooperation. For different forms of cooperation, the government should formulate corresponding training systems, and schools and industry subjects should gradually promote and implement them to ensure that the talents eventually cultivated meet the market demand.

The cooperation mode of "industry, university and government" in Japan aims to integrate resources in different fields and jointly participate in the product research and development of enterprises. A sound legal guarantee is the basis of "industry-university-government" cooperation. The government has set up a basic legal and regulatory system since the early stage to promote the cooperation between universities, R&D institutions and enterprises. Students can get in touch with the industry work of enterprises by participating in the cooperation. This model combines the traditional classroom education method with the enterprise practice, which is committed to the practice of theoretical knowledge and the cultivation of talents to meet the needs of the industry.

Germany's "dual system" model

Driven by the wave of industrialization, Germany has always adhered to the strategy of giving priority to higher education and science and technology. The subsequent emergence of higher business schools and applied technology schools has played an important role in the rise of Germany. The so-called "dual" refers to the "two" training, one refers to vocational colleges, mainly teach relevant professional knowledge; The other is an off-campus business or research institution that allows students to learn practical skills. Under the support of the government, the industry association works out the corresponding training objectives, assessment methods and talent programs according to the current situation of market development and the shortage of talents in enterprises, and then schools and enterprises respectively carry out relevant practical teaching. In order to form an effective operation mechanism, Germany promulgated a series of laws and regulations on vocational education after the 1950s, including the

Federal Law on Vocational Education and the Basic Law of Enterprises, which clearly distinguished the responsibilities and obligations of schools, enterprises, research institutes and local governments participating in cooperative education. In May 2019, the federal government deliberated and passed the Amendment to the Vocational Education Law, which improved the level of higher vocational education. The actual founder of the University of Berlin proposed that universities should combine the dual tasks of teaching and academic research. Modern universities are not only places for implementing higher education, but also places where creative inspiration is transformed into achievements. This idea has strongly promoted the reform of education mode and the development of natural science in Germany.

The "dual system" requires students to pass the training in universities and off-campus training bases before they can work. The teaching is carried out alternately between universities and enterprises, and the curriculum design focuses on vocational needs to help improve students' comprehensive analysis ability and practical solving ability. With clear pertinence and practicality, this kind of education mode can narrow the distance between school education and enterprise employment. On the one hand, students can practice what they have learned and improve their vocational skills under this kind of education mode. On the other hand, I also know the corporate culture in advance and broaden my contacts in the industry.

The experience of industrial model

Chinese industrial college is still in the process of exploration. Compared with developed countries, its scale, level, and effect need to be further improved. Under the background of economic and social development and universities' own development, the practical experience of international industrial colleges is provided as follows.

First, it is necessary to establish a flexible and diversified industry-university cooperation model with its own characteristics according to local conditions. The diversified construction modes of industrial college in Singapore, Japan and Germany show that industrial college is a flexible form of education on the one hand, and that each form has its own specific environment and conditions. We need to combine the regional industry trend, the characteristics of The Times and the characteristics of colleges and universities to develop a new model of "multiple integration" in order to meet the requirements of high-quality economic development in the new era.

Second, the organizational boundary should be broken to promote the integrated development of basic teaching and applied research. The "teaching factory" model of Singapore is influenced by the "liberal" economic theory, which emphasizes the unbounded realization of different markets and aims

at resource sharing and deep integration. Germany has always adhered to the unification of teaching and academic research, and must pass the training in schools and training bases before taking a job. Therefore, we should consider timely transformation of basic research results, respond to market needs, and promote the integrated development of basic teaching and applied research.

Thirdly, we should formulate feasible policies and regulations to promote the development of industrial colleges. Before the construction of industrial schools in Japan, in order to strengthen the sense of cooperation between schools and enterprises, and constantly improve the legal system, the perfection of German law has become a booster for the popularization of the "dual system". Through the form of law, the responsibilities, rights and interests of each subject in the construction of industrial college are clearly distinguished, which is conducive to the implementation of industry-academic cooperation.

THE MULTI-SUBJECT MODEL AND CHARACTERISTICS OF "GOVERNMENT-INDUSTRY-ENTERPRISE-UNIVERSITY" IN CHINA

As a new organizational form integrating industry and education, industrial college is the important path for the transformation to application of local undergraduate universities in our country. Under the multi-body mode of "government-industry-enterprise - university", co-construction industrial college is the type which is practiced in the construction of industrial college in our country, which is a multi-governance and trans-boundary complementary multi-win cooperative structure.

Through the incentive mechanism, the government guides enterprises to deeply participate in the education process of colleges and universities, and improves the coordination and overall planning of the two sides. Under the overall planning of the government, on the basis of local economic development, policies, regulations and management mechanisms concerning the legitimate rights and interests of both schools and enterprises shall be formulated, and a new mode of school-enterprise cooperation development shall be established with the government as the leading role, the industry as the intermediary, and universities and enterprises as the main body, so as to realize the development direction of local universities and enterprises and promote high-quality cooperation in running schools.

The industry association is the information provider for schools to set training goals, update the talent dynamics required by local economic development in real time, feed back the data results to universities, and convey the training situation of colleges and universities to enterprises, acting as the hub of information interaction between universities and

enterprises. In the process of school-enterprise cooperation, industry associations assist in the appointment of high-quality industry experts. As intermediaries, they assess the quality and performance of school-enterprise cooperation, coordinate the relationship between enterprises and other social subjects, and ensure that the discipline construction of colleges and universities is closely linked with the industrial chain of enterprises.

The university is the main body of education in this model. Through researching the demand for talents in the market, referring to the popular majors in the market, the school clearly defines the training direction of positions and the technical standards of enterprises, discusses valuable scientific research and innovation points with enterprises, and builds a teaching system with its own characteristics. At the same time, colleges and universities use the school-enterprise cooperation platform, school teachers go deep into enterprises to do research, and promote the exchange of talents between schools and enterprises, so as to achieve the ultimate goal of improving students' actual professional quality.

Enterprises are another educational subject in this model. In addition to connecting talents needed by schools, they also participate in the process of curriculum setting, making and modifying education plans, and teaching quality evaluation, and assist local colleges and universities to build application-oriented talent ability matrix. At the same time, it undertakes practical teaching tasks and supports colleges and universities to directly build productive training bases in enterprises. Relying on the cooperative innovation platform, enterprises and universities cooperate in scientific research projects to enhance the innovation ability of developing and sharing scientific and technological resources.

COUNTERMEASURES FOR THE CONSTRUCTION OF INDUSTRIAL COLLEGES IN LOCAL UNDERGRADUATE UNIVERSITIES

The construction of industrial college is a beneficial exploration of the transformation and development of local undergraduate universities under the background of the integration of industry and education, a further innovation to improve the orientation of education, promote the reform of talent training, and an effective way to expand the employment field and help local regional strategic development. To further explore and clarify the construction path of industrial college is the important premise of construction practice.

Give play to the leading role of the government and establish a modern governance structure

In the process of promoting industrial college, the role of local government in promoting and supporting can not be ignored. According to the local industrial

development status and regional economic development differences, the government should comprehensively plan the layout of talent training and strengthen the guidance for the cooperation between local high-quality enterprises and universities. On the one hand, the government should help colleges and universities to design the transformation and development path, and stimulate the consciousness of colleges and universities to serve the local through the guidance of relevant incentive policies. On the other hand, increase fiscal and tax incentives and policy-oriented support, give full play to the subjective initiative of enterprises to participate in talent training, guide multiple forces to coordinate on governance objectives, and improve the function of industrial college in talent training and service industry.

Reduce the operation cost and optimize the operation mechanism of industrial college

Before the cooperation, both the school and the enterprise of the industrial college will consider whether to cooperate based on the expected benefits and costs, and take the compatibility of multiple interests as the starting point to meet the basic demands of stakeholders' interests. The interests of both sides should be guaranteed, the corresponding marketization of educational achievements should be fully combined with the proximity of industrial clusters within the region, and resources should be shared synchronously while information asymmetry should be avoided. In addition, it is necessary to establish a school-enterprise collaborative training mechanism, a school-enterprise teacher sharing mechanism and a "co-training" mechanism. On the one hand, industrial colleges can integrate "teaching, learning, training and evaluation" into the training process organically and innovate the talent training program according to the different division of labor and the different focus of the enterprise post standard and the school education standard. On the other hand, we should give full play to the leading role of senior professionals in enterprises in technology, encourage school teachers to participate in practical learning and enterprises to participate in school training and scientific research, and smooth the channels for optimizing the integration of enterprise resources and school educational resources.

Establish advanced school-running philosophy and improve the cognition of serving local areas

Local colleges and universities should create the training mode with the characteristics of local economic development, establish the accurate idea of industrial college, clear the direction of serving the local education, take the initiative to adapt to the development of local economy, and set up the long-term strategic goal of serving the local development. To understand the latest trends of the market and investigate the reasonableness of specialty setting and

planning, we actively cooperate with local high-quality enterprises to create an integrated ecosystem of industry and education. After understanding the local market conditions, the industrial school should improve the cognition of local services, give full play to the advantages of keeping up with the pace of the market, according to the principle of "emphasizing foundation, emphasizing practice and emphasizing application", so as to realize the quality of talent training relative to the market demand.

Accurate research and judgment of subject characteristics, clear innovation path of industrial college

Curriculum setting is an important content of service quality level. In the same university, different industrial colleges have different construction paths, so each industrial college should determine a scientific and reasonable construction plan according to its own subject characteristics, local industrial development status and stage construction tasks. On the basis of selecting the industrial chain and innovation chain of specific services, the characteristics of construction disciplines should be fully considered, and the division of labor should be concreted and refined through the mutual integration, collision and derivation between related disciplines and specialties. From the perspective of the system, we should comprehensively consider the logical relationship between the development of various disciplines and majors, carry out different characteristics of the division of labor for the same industrial chain and innovation chain, so as to lead the development of specific industries, create a systematic training system for the accurate and effective training of innovative and compound high-quality talents, and promote the characteristics and level of colleges and universities.

CONCLUSIONS

The integration of industry and education is one of the key difficulties in the development of higher education, and the development of industrial colleges provides an effective way to deepen the integration of industry and education. This paper introduces the concept and organizational characteristics of industrial colleges, explores for reference experience by comparing the construction mode of industrial colleges in international countries, and on the basis of this, puts forward some countermeasures and suggestions for the construction strategy of industrial colleges in local undergraduate universities.

ACKNOWLEDGEMENTS

This work is supported by the Hebei Higher Education Teaching Reform Research and Practice Project, China (Grant No. 2020GJJG456).

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