Exploration and Practice of Deepening Industry-Education Integration Mechanism in Guangxi Applied Undergraduate Universities and Colleges

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ABSTRACT
Close college-enterprise cooperation, resource sharing, mutual benefit and win-win result are the main characteristics of modern applied undergraduate higher education. Promoting industry-education integration is an inevitable choice for applied undergraduate universities and colleges to adapt to the development of society, economy and applied undergraduate higher education. In order to make a further study on the effective ways to deepen industry-education integration in applied undergraduate universities and colleges, this paper analyzes its connotation, mechanism and model, proposes the construction of three different integration mechanisms from the perspectives of government, enterprise and university and college, and the third party and put forwards four practical models of industry-education integration which can achieve win-win situation with the practical experiences of Guangxi's applied for undergraduate universities and colleges. It provides a certain reference for applied undergraduate universities and colleges to deepen their industry-education integration.

Keywords*: industry-education integration, applied undergraduate universities and colleges, mechanism, model*

1. INTRODUCTION

In December 2017, the General Office of the State Council issued *Several Opinions on Deepening Industry-Education Integration*, which makes industry-education integration become an important part of national overall institution of education reform and talent cultivation. It has an important reality meaning for solving the imbalanced status between talent supply and demand[1]. On the basis of analysing and comparing domestic and foreign advanced school running models, industry-education integration gradually develop and become an important education method and model. It is a new path to solve the problem that current vocational education and higher education, as the supply side of applied talents, are not fit for the structure, quality and level of industrial development. Industry-education integration is not only a system designed for schools and enterprises, but also an allocation method to optimize educational resources, social resources and the utilization of time and space. In 2019, National Development and Reform Commission and other five ministries and commissions jointly issued *National Pilot Implementation Plan for Industry-Education Integration*, which clearly stated that deepening industry-education integration reform should be regarded as a strategic task of promoting the structural reform on the talent supply side. Therefore, promoting industry-education integration becomes an inevitable choice for applied undergraduate universities and colleges to adapt to the development of society, economy and applied undergraduate higher education.

In the development of industry-education integration of applied undergraduate higher education, many experts and scholars have carried out in-depth studies on industry-education integration mechanism from different perspectives. For example, Dan Guan took Changzhou Vocational and Technical College of Engineering as an example to explore the long-term mechanism of industry-education integration from the aspects of resource integration, mechanism innovation, and system guarantee[2]. Caisheng Mao studied the development path of industry-education integration of local applied undergraduate universities and colleges from the perspective of symbiosis theory[3], Yongxian Chen proposed measures to deepen industry-education integration from three aspects of optimizing coupling mechanism, cooperation mechanism and incentive mechanism[4]. Foreign scholars also have a lot of researches on industry-education integration. For example, Wright respectively discussed the application of different

cooperation models at the different technical stages, and proposed three cooperation models of industry-education integration at different technical stages[5]. However, there are just a few corresponding researchs on the deep industry-education integration mechanism and its innovative models of applied undergraduate universities and colleges. This paper focuses on analyzing the connotation, operation mechanism, and practical model of industry-education integration of applied undergraduate universities and colleges and discussing the effective ways to deepen industry-education integration and its innovative mechanism models with examples of industry-education integration achievements of Guangxi applied undergraduate universities and colleges.

2. THE CONNOTATION OF INDUSTRY-EDUCATION INTEGRATION OF APPLIED UNDERGRADUATE UNIVERSITIES AND COLLEGES

Industry and education belong to two different major social systems. Their integration and harmony only can be achieved under the circumstance when they enter a coordinated and coupling state. Different essential attributes and social functions provide industry and education with different mechanism design, operation model and value orientation, which inevitably creates many difficulties for their integration[6]. For example, the development plans of universities and colleges are not fit for regional economic development; discipline and specialty setting is not coordinated with industrial development trend; the technological research and development of universities and colleges is out of step with industrial technological innovation; industries and enterprises are lack of enthusiasm to participate in industry-college cooperation, and so on. However, industry-education integration has great shared advantages for both parties. For universities and colleges, the integration is beneficial to improve the quality of talent cultivation and promote the development of applied undergraduate higher education; for industries and enterprises, it can promote scientific and technological innovation, the conversion rate of scientific research results, and the economic benefits of products. Therefore, a common cooperative vision of the both sides is the basis for the industry-education integration.

Applied undergraduate universities and colleges are the institutes of higher learning that mainly cultivate applied talents, and serve the local economic and social development. In 2015, the Ministry of Education, the National Development and Reform Commission and the Ministry of Finance jointly issued *Guiding Opinions on Leading Some Local General Undergraduate Universities and Colleges to Transform into Applied Universities and Colleges* which formally defined the applied undergraduate universities and colleges. It clarifies the national policy orientation for the construction and development of applied undergraduate universities and colleges, and stipulates "four transformation" as running concept for general undergraduate universities and colleges. It proposes that the school-running concept should be transformed to serve local economic and social development, industry-education integration and technical applied talents cultivation, and to enhance students' abilities of employment and entrepreneurship[7]. School-enterprise cooperation and industry-education integration are two main carriers and paths for applied talents cultivation. For applied undergraduate universities and colleges, industry-education integration is a full-process and in-depth integration in the fields of education, teaching and scientific research between industries and universities and colleges. It spans the boundaries between vocation and education, enterprises and schools, work and study, and gradually realizes a close links between discipline and specialty setting and industries' job requirements, curriculum content and vocational standards, teaching process and production process, graduation certificate and professional qualification certificate, and vocational education and lifelong learning. In order to realize industry-education integration of applied undergraduate universities and colleges, the relationship between the two parties must be guaranteed and restricted from the aspects of organizational structure, decision-making method and operating mechanism, and the operating system of the deep cooperation between schools and enterprises in teaching and practical training should also be clarified.

3. INDUSTRY-EDUCATION INTEGRATION MECHANISM IN APPLIED UNDERGRADUATE UNIVERSITIES AND COLLEGES

Industry-education integration is a systematic project, which requires government, industry, enterprises, and universities and colleges to form a joint effort and a unified understanding to promote it together. There are three mechanisms that need to be built to achieve industry-education integration.

3.1. The Leadership and Design Mechanism of Government

Cultivating applied talents is a specific manifestation of adjusting and optimizing national economic structure, which requires government to formulate related polices and design related rules and regulations. The mechanism at government-level includes two aspects. The first one is that national macro policies should be carried out to support industry-education integration, and guide industries, enterprises, universities and colleges to participate in it. The policies should clarify the responsibilities, rights and interests of all parties in the process of implementing industry-education integration. *Several Opinions on Deepening Industry-Education Integration* and *National Pilot Implementation Plan of Industry-Education*

Integration are issued to clarify government's leading position in the promotion of industry-education integration, and point out how to promote and implement the integration from the perspectives of macro guidance and micro implement. The other one is that the local governments at all levels should have a good plan and design of industry-education integration from the perspective of industrial structure and development. Of course, it should be based on the actual development of society and economy.

3.2. The Operation and Transformation Mechanism of School and Enterprise

School is the producer and disseminator of knowledge, as well as organizers and implementers of scientific research and teaching activities, which produces and supplies nutrition for industry-education integration; while the enterprise is the main place for knowledge testing and product generation, and it is both consumer and reprocessor of knowledge. In the process of deepening industry-education integration, applied undergraduate universities and colleges should adhere to the local needs and the characteristics of regional economic and social development, rationally set up disciplines and specialties, optimize talent cultivation programs, improve applied research capabilities, strengthen the introduction of "Shuangshi" (dual qualified teachers), and build innovation and entrepreneurship platform to promote the integration of scientific research, school resources, human resources and enterprise resources, thereby continuously improving the practicality of knowledge, the social adaptability of talents and the social service capabilities of schools. In the process of industry-education integration, enterprises improve their economic and social benefits by acquiring high-quality applied talents and the applied technologies in line with their own development. The enterprises then feedback the talent cultivation and the applied research of applied undergraduate universities and colleges through conducting joint education program, participating in talent cultivation, and joint constructing research institutions and so on, thereby establishing a benign operation and transformation mechanism.

3.3. The Restraint and Supervision Mechanism of the Third Party

The government should establish an evaluation agency that involves education departments, industries, and associations, and build a scientific and reasonable evaluation index system for industry-education integration and build an information service platform to improve the evaluation mechanism of the third party. Strict monitoring and assessment for industry-education integration also need to be conducted. It is necessary to make full use of market cooperation and industrial division to build a community of interests between schools and enterprises, and form a stable and mutually beneficial cooperation mechanism to achieve a closer connection between schools and enterprises. In addition, the laws and regulations concerned with the industry-education integration should be improved. A number of laws and regulations about cultivating applied talents are issued in Germany, which elaborate the professional knowledge, practical skills, codes of conduct, psychological qualities and so on required by different occupations in details. It has a great reference significance for applied talents cultivation in China. What's more, the laws, regulations and policies should be refined to lay a good policy foundation for industry-education integration, and to effectively protect the rights and interests of enterprises and applied undergraduate universities and colleges[8].

4. PRACTICAL MODELS OF INDUSTRY-EDUCATION INTEGRATION IN APPLIED UNDERGRADUATE UNIVERSITIES AND COLLEGES

Applied undergraduate universities and colleges undertake the main tasks to cultivate high-level engineering applied technical talents for high-tech departments and technology-intensive industries, managers and organizers for production line and teachers for vocational schools[8]. In terms of the specific model of industry-education integration, applied undergraduate universities and colleges should continuously innovate it according to their own advantages. Except for school and enterprise, local government and students also need be involved in the industry-education integration. It's important to coordinate and couple the interests and goals of all parties, link-related factors at the early stage with the guarantee factors at the later stage of industry-education integration to build a benign integration model, and ultimately achieve a win-win situation for all parties.

4.1. The Integration of Discipline and Specialty Setting and Regional Economic and Social Development

In order to achieve deep integration of industry and applied for undergraduate universities and colleges, the integration of discipline and specialty setting and regional economic and social development must be achieved at first. Base on the actual development of regional economy and society, applied undergraduate universities and colleges should link their disciplines and specialties with the development of leading industries, vigorously optimize disciplines and specialties with the demand of industry, establish a dynamic adjustment mechanism for the deep integration of discipline and specialty setting and regional economic development, and strive to create advantageous disciplines and specialties with regional characteristics. Guided by the demand of leading industries, Beibu Gulf University has

canceled 34 majors successively, focuses on constructing two discipline and specialty clusters of Marine Biology and Technology and Marine Transportation and Engineering, and aims to create marine characteristics. Wuzhou University makes great efforts to build "4+9" discipline and specialty clusters and the cluster system that closely connect with the industrial chain to adapt to the regional economic and social development of "Three Circles and One Belt" (Pearl River Delta Economic Circle, Beibu Gulf Economic Circle, Greater Southwest Economic Circle, and Pearl River-Xijiang Economic Belt), and Guangdong-Hong Kong-Macao Greater Bay Area. Linking with the industrial development plan of *Zuojiang and Youjiang River Revitalization Strategy*, Baise University proposes to create "3+3" discipline and specialty clusters to serve six major industrial chains of Baise, including ecological aluminum industry, organic ecological agriculture, information technology, new urbanization, border minority ethnic culture and foundational education for border minority nationalities.

4.2. The Integration of Talent Cultivation and Human Resource Demand of Enterprise

The participation of enterprises in the process of talent training should be strengthened. On the premise of respecting the laws of education, the talent cultivation program should be adjusted in time with the pace of enterprises' human resource demand to increase the satisfaction of industries and enterprises with applied talents. For example, in order to deepen industry-education integration, Hezhou University and enterprises jointly established 7 industrial colleges with the investment of tangible and intangible resources. The industrial colleges and the original secondary colleges of the university share the same faculty, which is so-called "two colleges in one" model. The quality of applied talents has been significantly improved by carrying out university-enterprise collaborative education and building the "two colleges in one" cooperative model. In 2019, the employment rates of 187 graduates of Information and Communication Engineering College (ZTE Information Technology College), majoring in Communication Engineering and Internet of Things Engineering, respectively reached 97.2% and 96.88%, and the professional counterparts rates respectively reached 93.6% and 96.7%. It shows that the quality of talent cultivation is recognized by the society, and the unification of high-quality applied talent cultivation and high-quality employment is realized in this way.

4.3. The Integration of Scientific Research and Technology Application

Applied undergraduate universities and colleges carry out scientific research based on their own professional scientific research teams and abundant research resources, and the technological achievements formed in process of scientific research are preferentially transferred to cooperative enterprises. What's more, the two parties can jointly establish research and technical teams to solve the technical difficulties in the production process. Helping enterprises improve product quality and economic benefits is to help universities and colleges increase scientific research achievements, improve service capabilities, and finally achieve a deep integration of scientific research and technology application. For example, Liuzhou Institute of Technology attracts enterprises to enter the campus to carry out production activities by providing venues and equipment to enterprises, and assists them to make breakthroughs in scientific and technological research by providing support from the aspects of technical research and development, technical consulting, and technical services. The institute has successively signed project research and development contracts with Guangxi Laiji Biological Engineering Co., Ltd., Guangxi Seven-color Pearlescent Material Co., Ltd., Maanshan Tangtuo Rock Drilling Machinery Co., Ltd., and other enterprises. Automotive Engineering Department cooperated with Kettering University and SAIC-GM-Wuling Automobile Co., Ltd. to jointly conduct scientific research projects on noise, vibration and harshness. In this way, enterprises can effectively experience the complementary advantages of school-enterprise cooperation. It will enhance the cooperation confidence of both parties, and finally, expand the cooperation scope and deepen the cooperation connotation.

4.4. The Integration of School Management and Enterprise Activities

Cultural factors such as enterprise management, enterprise systems and so on should be incorporated into the process of applied talent cultivation to strengthen students' cognition of "dual culture" and shorten their adapting time to positions. Nanning University reorganized its management system and mechanism in accordance with the requirements of applied undergraduate universities and colleges and established new management institutions such as Industry-Education-Research Department. The management model of dual-subject Industry-education collaborative education is implemented, and four industrial colleges were jointly established with ZTE, IFLYTEK, former Guangxi Quality Supervision Bureau, Gaobo Education Group and other units. Enterprises' managers are hired as industrial college's managers, and enterprise experts are hired as full-time teachers. The enterprises participate in the whole process of talent cultivation, and the two parties strive to form a collaborative internal governance system of the applied undergraduate university.

5. CONCLUSION

Industry-education integration has become a national strategy. It is the main carrier for comprehensively improving the quality of talent cultivation of applied undergraduate universities and colleges, and the main way to meet the national economic and social development demand for applied talents. However, the concept of industry-education integration still needs to be continuously deepened and broadened with the pace of economic and social development. It is necessary to constantly enrich its theoretical connotation, optimize its operating system and mechanism, and innovate its practical model in practice. In this way, the effectiveness of applied talent cultivation will be better and it will further promote social and economic development.

ACKNOWLEDGMENT

Fund Project: Guangxi Education Science "13th Five-Year Plan" 2017 Key Funding Project "A Study on Innovative Mechanism of Industry-Education Integration of Guangxi Applied Undergraduate Higher Education" (Grant No. 2017A037)

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