Research on The Innovation of Education Mode in Local Applied Undergraduate College: Based on The Reference of “Dual System” and “Sandwich”

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Abstract: “Sandwich” education model originated from Britain, and its distinctive talent cultivation and teaching model has become a model of industry-university-research cooperation. German “dual system” vocational education is the secret weapon of the re-emergence of German industry after the Second World War. China's local applied undergraduate college play a role in linking research universities with vocational colleges and universities, and play an important role in the regional innovation system. By comparing and learning from the “sandwich” education model in Britain and the “dual system” education model in Germany, and summarizing their characteristics, structure and effects, the innovation of the education model of Chinese application-oriented universities should focus on solving the following problems: adhering to the vocational orientation and paying attention to the education concept of cultivating students’ “key ability”. Innovation of scientific research teaching system and mechanism, production and learning cooperation education mode, improve talent training mode. Local governments formulate specific management measures to promote school-enterprise joint talent training mode. We will reform the system of vocational qualifications. Strengthen the cooperation between colleges and universities, and attach importance to the connection between research universities and higher vocational colleges.

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Talents are the core competitiveness of a country and a region. As one of the important power sources of regional innovation system, colleges and universities that cultivate senior talents have a direct impact on the development of regional economy and industry. The current Chinese higher education structure is undergoing profound changes, according to a 2015 the ministry of education, the national development and reform commission, ministry of finance on parts of the ordinary undergraduate course colleges and universities to applied guidance, many local undergraduate colleges and universities are actively to the practical transformation, school-running ideas to serve the local economy development, positioning for local applied undergraduate colleges. China's local application-oriented universities play a key role in regional innovation by linking a few research universities with vocational colleges and universities.

The UK higher education has a long history and the quality of education has been recognized by the world. Its “sandwich” education model originated from Sunderland Technical College (now renamed Sunderland university), and its distinctive talent cultivation and teaching model has become a model of industry-university-research cooperation. This mode has become the most common talent training mode in British occupation, and has been widely recognized by the society and internationally influenced. German “dual system” vocational education is the secret weapon of the re-emergence of German industry after the Second World War. “Sandwich” and “dual system” mode have their similarities, but have their own characteristics. Local undergraduate colleges and universities in China actively applied transition oriented era background, the local undergraduate colleges and universities must learn from the success of the two modes, and both strengths and explore the innovation education mode, better service, for the area (especially the city) provide a matching market innovation resources.

1. The Success Factors of the German “Dual System” Model

The “dual system” vocational education in Germany has cultivated a large number of excellent technical personnel for “made in Germany”, and developed vocational education has become the secret weapon for Germany's industrial and
economic take-off after the second world war. The success factors of German vocational education can be simply summarized as the following points.

(1) The talent market is career-oriented and attaches great importance to vocational qualification certification

German talent labor market has obvious characteristics of career orientation, and the recruitment, flow and income of talents are mainly based on professional qualifications. Comparatively speaking, the recruitment and flow of talents in China are mainly based on educational background, which largely determines the income of talents. The characteristics of Germany’s job-oriented talent market provide unique conditions for the prosperity and vigorous development of vocational education, thus making the correlation between college vocational education and the job market more closely. In Germany, young people have to take vocational training and certification tests to work in a certain industry. Even farmers have to pass the relevant qualification tests before they can take jobs. The levels of vocational qualifications in Germany are high, medium and low, and skilled workers with higher levels of vocational qualifications do not have to earn less than university students and are often even higher. The social atmosphere that values vocational qualifications is also a key factor contributing to the success of vocational education in Germany.

(2) High participation of enterprises in running schools

Compared with the traditional apprenticeship model, the “dual system” increases the time and content of theoretical study in universities for students (apprentices), and enhances the overall quality of students. German enterprises have their own tradition of training apprentices, and the biggest driving force for training apprentices is the need of enterprises’ own development. German manufacturing has always won the market through high-quality products. Enterprises attach great importance to the training of skilled workers, and the cultivation of apprentices helps enterprises to have high-quality employees, which is one of the core competitiveness of German enterprises. Because of the above reasons, the “dual system” based on the traditional apprenticeship system naturally has the leading power of enterprises, which are willing to invest capital and other resources to actively participate in vocational education. High participation of enterprises is the only way to improve the quality of vocational education in Germany, and provides a guarantee for the success of “dual system” mode.

(3) Develop a strong sense of professional identity

One of the keys to the success of made-in-germany is the dedication of ger-
mans. The germans’ high professional identity is reflected in their professiona-lism. In Germany, children grew up exposure to various working environment (some of them are industrial museum through the contact form), cultivate their professional qualities, and when the children grow up into the study field of vocational education, most can find their favorite professional types (many of the children affected by family established career aspirations as a child). After entering the enterprise, the teachers will also help them with career planning, cultivate their sense of professional identity and high sense of responsibility. Professional identity is also an important factor for the success of vocational education.

(4) Vocational education was advanced to the stage of compulsory education

The most distinctive feature of the German education system is to advance vocational education to the stage of compulsory education. Germanism Vocational education is applicable to the economy. Primary school is to achieve talent diversion, from primary school, continue to create opportunities for children to contact all kinds of work. German primary school students will be separated after 4 years, respectively corresponding to ordinary high school and practical high school, the latter course has strong career orientation. This kind of post-primary education system can make better use of educational resources and lay a more solid foundation for vocational education.

2. The Success Factors of the British “Sandwich” Model

The vocational education system in Britain is the world's most mature, the most comprehensive, one of the most flexible system of vocational education, the vocational education mode of cooperative education breaks through the traditional mode of personnel training, to form the government, industry associations, business community and vocational colleges participating, three-dimensional integrated production mode of innovative education, is a kind of “theory-practice– theory” or “Practice–the theory–practice” training mode of combination, students study in school and enterprise practice alternate form a “sandwich” model of curriculum. It has important reference significance for the perfection of new talent training mode of modern higher education in China. The success factors of the sandwich education model in the UK can be simply summarized as follows.

(1) Oriented by career and market demand, attach importance to the cultivation of core competence

The reason why the “sandwich” education mode of combining work and study has experienced a hundred years is firstly attributed to its practical educational
concept: to cultivate students’ actual employment competitiveness by taking occupation as the guidance and market demand as the purpose, to help students apply what they have learned and improve their comprehensive ability. The core competencies involved in sandwich education in the UK include literacy, numeracy, cartography, problem solving, research, transaction processing, independence, hands-on ability, personal and moral cultivation, physical environment and technical environment. Entering the new century, the British education and employment, the confederation of British industry and qualifications and curriculum department jointly will further condensed into six core ability, namely, communication, digital, information technology, working with people, improve self learning and improving performance and problem solving skills, it also became the standard current national qualifications framework system of the six core competencies.

(2) Execute contemporary apprentice to make, the talent that study combines is cultivated mode

Sandwich education adopts the alternation mode of “theory -- practice – theory”, emphasizing the curriculum structure of practice. At the same time, the British government has promoted the “modern apprenticeship” program, which aims to cultivate a new type of worker by providing young people aged 16-24 with a work-based learning route and integrating theory with practice. The system divides the training objectives into basic and advanced modern apprenticeship, which respectively cultivates practitioners with primary vocational skills and skilled vocational skills. Completion of advanced modern apprenticeship leads to the national vocational qualification (NVQ) level 3 and key skills level 2 and related technical certificates. Modern apprenticeship courses include the key skills course, the NVQ course and the technical certificate course, through which one obtains the vocational and working abilities necessary for the occupation, the vocational qualification certificate, the technical certificate that evaluates the specific vocational knowledge and understanding and provides the basic knowledge for obtaining the national vocational qualification. Modern apprenticeship system adopts the teaching mode of alternation between work and study. The whole apprenticeship period is generally 4 to 5 years. In the first year, the apprenticeship is released to the institute of continuing education or training center for study. After the completion of the apprentice training program, the corresponding vocational qualification certificate can be obtained through the examination.

(3) The government actively promotes and strengthens the cooperation between industry, universities and research institutes

The British government played an extremely important role in the maturity of
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the sandwich education model. The British government has always played a leading and governing role. In the aspect of policy support, the government exert its advantages, actively guide the learning object in society to participate in vocational and technical study, through policy and propaganda promotion vocational and technical education in the position in the society as a whole, “industry training law” promulgated, “education reform act of 1988”, “education and training of the 21st century” and so on policy and law, provide strong sandwich education mode to promote legal policy support. In terms of financial support, the “national employer training program”, launched in 2005, focuses on the needs of employers. The system of “training vouchers”, on the one hand, provides free training for low-skilled workers and post-secondary youth; on the other hand, the initiative of students’ choice of schools and courses brings funds into high-quality schools and courses that students like, and promotes the efforts of schools and training institutions to improve their own standards and quality.

(4) Double tutorial system and whole process assessment

The “sandwich” mode of education that emphasizes practice, skills and application has been widely promoted. During the internship of students in enterprises, “double tutors” are implemented so that teachers have opportunities to contact with the business community and promote the combination of teaching and production practice. The school can adjust the professional structure and update the teaching content according to the feedback from the enterprise, so as to enhance the school’s adaptability. Students need to accept the assessment of school theories and the guidance and assessment of “tutors” in colleges and universities. In the stage of enterprise practical learning, I also need to accept the guidance and assessment of the enterprise “mentor”.

3. Thoughts on the “Dual System” and “Sandwich” on the Model of Chinese Application-oriented Undergraduate Education

Compared with the students from key universities, the graduates from local universities are lack of theoretical depth and inferior in practical skills compared with the graduates from vocational and technical schools. At the same time, employers in the talent market are not satisfied with the “emphasis on discipline system while ignoring skills” in key universities -- the disconnection between theory and practice; Also not satisfied with the vocational and technical college “focus on operational skills and ignore the theory” -- students lack stamina. For a local university, how to train students and improve employment rate has become a very im-
important issue. Since the reform and opening up, China's economy has been developing rapidly and the demand for talents has been constantly increasing. In particular, under the background of current economic transformation, high-level application-oriented talents are in short supply. At present, the students trained under the mechanism of university education cannot meet the demand of “focusing on skills and theories”.

Through comparison, it is found that Germany and Britain always adhere to the quality concept of “occupation and ability” as the core in the process of developing higher vocational education, and have something in common in the cultivation mode. The successful experience of “sandwich” and “dual system” can be used for reference in the reform of talent cultivation mode of local universities in China.

(1) Adhere to the vocational orientation, pay attention to the education concept of cultivating students’ “key ability”

“Dual system” or “sandwich” model, Germany and Britain's vocational education ability training is the essence of the concept highlights the students' ability to standard, the training goal is to make the students master the basic theory knowledge and professional practice skills, be able to transform scientific and technological achievements into products applied engineer or higher management level of enterprise engineers, thus emphasizing “key ability” training.

In 1974, D Mertens of Germany first put forward the concept in key competence -- educational proposition of modern society. According to mertens, critical competence is a “universal, transferable ability that plays a key role in the future development of workers”. Ma qingfa (2002) believes that “key competence” refers to the competence that has no direct relationship with pure professional professional functions and professional knowledge and transcends the scope of professional skills and professional knowledge, such as independent learning, lifelong learning, independent planning and implementation, independent control and evaluation, etc. In order to cultivate students’ “key abilities”, the original reference to the setting of the professional and curriculum system of research universities should be reformed into the professional and curriculum structure oriented by occupation and ability. It can be predicted that with the emergence of new and interdisciplinary occupations, local application-oriented undergraduate colleges and universities should shift from impart individual skills to cultivate comprehensive abilities in terms of training objectives, and pay more attention to the talent specifications of employers in terms of value orientation. To be specific, new majors can be set up and interdisciplinary and interdisciplinary disciplines can be developed. On the other hand, the scope of professional knowledge and professional direction can be broadened through in-
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ter-school cooperation such as inter-school course selection.

The curriculum should be based on modern science and technology and centered on vocational education. At present, the curriculum reform of many local universities in China involves both theoretical courses and practical courses, but compared with those in Germany and Britain, the domestic curriculum lacks a key link of “practical learning”. “Dual system” and the “sandwich” is a common key school students, together with the enterprise which the school enthusiasm of enterprises and high participation of personnel training, the students can be more in the actual enterprise “practical learning”, “practical learning” link “key ability” of students training plays an important role.

(2) Innovation of scientific research teaching system and mechanism, production and learning cooperation education mode, improve talent training mode

Over the years, the reform of talent cultivation in local universities has been impeded mainly by the problems of system and mechanism, which leads to the lack of motivation of industry-university cooperation in talent cultivation. There are not only problems of top-level design and macro management system of education reform, but also problems of organization and coordination and profit distribution among universities, government and enterprises. From the perspective of colleges and universities themselves, the original teaching and research are disjointed from the development of local economy and industry, resulting in the “two skins” separation between college research and enterprise application. The traditional scientific research system is not conducive to the joint training of talents. Therefore, local universities and colleges should take the initiative to innovate the scientific research system and mechanism, promote scientific research work with the guidance of “combination of university and enterprise”, and actively carry out characteristic scientific research. We should focus on the characteristics of regional economic and social development, coordinate scientific research work and main direction, build characteristic scientific research on the basis of industry-university research cooperation projects, and integrate the development of local economic and social industries as the main direction of scientific research projects. Characteristic scientific research activities and achievements are the elements and interfaces for local application-oriented universities to participate in regional industry-university cooperation, and also one of the bases for industry-university cooperation to jointly cultivate talents. On this basis, only by promoting teaching with characteristic scientific research can the teaching supported by scientific research be formed, and both scientific research and teaching are “down-to-earth”, so as to realize the goal of training high-quality application-oriented talents in line with local social and
economic development.

Local application-oriented universities should rely on the existing scientific research bases, closely focus on the local needs, and integrate with the local social and economic industries for development, take this as the purpose to innovate the mode of industry-university-research collaborative innovation education, improve the quality of application-oriented talents training and enhance the ability to serve the local. To be specific, for example, strategic alliances can be established with enterprises of local pillar industries or characteristic industries, and school-enterprise cooperation can be signed to carry out order-type training, including joint talent training, project scientific research and base co-construction. We can also establish a generic technology innovation research and development platform with local enterprises and research institutes to strengthen students' off-campus practice and training. In addition, in terms of collaborative innovation, the trinity mode of “achievement transformation + discipline construction + talent cultivation” should be gradually established with multi-party project cooperation as the bond. The needs of the local economy industry as tightly gripper collaborative education model of production, to establish a local undergraduate colleges unique competitive advantage, schools play to the talents cultivation, scientific research and social service three big functions of initiative and enthusiasm are further enhanced, to drive scientific research achievements transformation, and feedback of teaching by scientific research (subject construction and talents training), will make the applied talents training quality is greatly increased.

(3) Local governments formulate specific management measures to promote school-enterprise joint talent training mode

Over the years, the German government by formulating relevant laws and regulations to ensure the “dual system” mode in the fulfillment of their respective responsibilities for both schools and enterprises, and the UK from the Percy report, the crowther report published to the industrial training act, the act of employment and training, also reflects the higher vocational education in the role of laws and regulations and state intervention. At present, similar laws and regulations in China are far from enough. Local governments can take the initiative to develop supportive management measures for promoting the school-enterprise joint talent training model in their regions. For example, we can learn from the government subsidy fund set up by the German government to encourage enterprises to participate in the “dual system” to cultivate the enthusiasm of application-oriented talents, and give certain financial support to enterprises (especially small and medium-sized enterprises) that cooperate with local universities to train students and provide a
certain number of practical jobs. The government should provide policy support and specific matchmaking for the cooperation between local universities and enterprises in the cultivation of talents under administrative management, take the initiative to give play to the innate advantages and abilities of local governments in mobilizing resources of all parties, and actively guide the cooperation between universities and enterprises.

(4) Reform of the vocational qualification certificate system

Both Germany and Britain have a scientific and standardized vocational qualification system. German “dual system” mode, the students should not only learn professional technology, but also learn the cultural knowledge on admission qualification (in fact, the German vocational colleges students must be considerable cultural basis), the British general national vocational qualification certificate system's original intention is to get through the gap between vocational education and ordinary education, both of which reflect the general education, cultural education in higher vocational education the important meaning. Due to the influence of traditional mode and social identity, Chinese higher education attaches more importance to the level of academic qualifications, and pays much less attention to vocational qualification certificates than that of Germany, Britain and other developed countries. In the future, all parties (government, industry associations and universities) should communicate and cooperate more actively in the identification and management of vocational qualification, jointly formulate the system of industrial qualification acquisition and grading examination, and reform and innovate the Chinese vocational qualification certificate system. The specific reform direction can be started from two aspects: on the one hand, reform the relevant regulations on college students' obtaining vocational qualification certificates during their study in the university, strengthen the regulations on students' obtaining vocational qualification certificates before graduation, and make specific regulations on grade and quantity. On the other hand, it is necessary to improve the qualification of teachers for vocational education, attach importance to the construction of teachers, strengthen teachers' continuing education, and stipulate the level of teachers' professional qualification certificates obtained by colleges and universities or enterprises that teach practical courses. In a word, it is necessary to gradually form the awareness that college graduates must hold relevant industry qualification certificates before entering the job market and change the society's bias of credential orientation.

(5) Strengthen the cooperation between colleges and universities, and attach importance to the connection between research universities and higher vocational colleges

The types of social talents can be divided into four types: skilled, technical,
engineering and academic. Higher vocational colleges are mainly aimed at cultivating technical talents at the junior college level, application-oriented colleges are mainly aimed at cultivating technical and engineering talents at the undergraduate level, and research-oriented universities are mainly aimed at cultivating academic talents. At present, China’s “general higher education” and “higher vocational education” have two legs, which are “lame and lame”: general higher education includes both theoretical and academic types and technical application types, and the levels of junior college, undergraduate and postgraduate are complete, while higher vocational education only has the level of junior college. Compared with abroad, the current Chinese higher education personnel training structure still exists many need to perfect place, the personnel structure of the main problems is the skill applied talents and academic talents in the vacuum degree of cohesion, and also for applied skills talents to stay in college degree under low levels of awareness. In fact, talent training, like scientific and technological innovation, needs to be “inimitable”, which not only pays attention to the cultivation of original theoretical innovative talents, but also pays attention to the cultivation of a large number of high-level application-oriented innovative talents above undergraduate level to improve the conversion rate of scientific and technological achievements and serve the social and economic development of the region. Local application-oriented undergraduate colleges have natural institutional advantages in connecting research-oriented universities with higher vocational colleges. They should take advantage of this advantage to actively cooperate with regional research-oriented universities and higher vocational colleges, and cultivate talents through collaborative innovation, so as to form a complete application-oriented talent training system from junior college, undergraduate to postgraduate level.

4. Conclusion

Through using the “sandwich” and German “dual system” mode of education, China’s local applied undergraduate colleges and universities can be found in students “key ability” cultivation, scientific research and teaching system and mechanism innovation, the cooperative education between production mode, the local government support, reform of the professional qualification certificate system, and strengthen the reform of colleges and universities must be carried out in cooperation with various and innovating the mode of education. Local applied undergraduate colleges and universities in the future also need to strengthen the top-level design and strategic planning, focus on the cultivation a long-term mechanism of cooperation between production and collaborative education mechanism aspects of
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innovation, draw lessons from foreign advanced production, diversification of cooperation mode of education reform and innovation, to promote practical transformation process, to rapidly promote national and regional innovation ability and performance play an important role.

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