

Research on Reconstruction of Mechatronics Professional Chain and Construction of Talent Training Community

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Abstract: In view of the common problems existing in higher vocational specialties such as the separation of industrial chain, professional chain, talent chain and innovation chain, and in connection with the regional intelligent manufacturing product research, design, manufacturing and large-scale personalized service industrial chain, this paper conducts an empirical study on the reconstruction of mechanical and electrical integrated professional chain and the construction of talent training community based on the in-depth integration of industry and education. The method of chain interworking, intelligent collaboration, multidimensional interconnection and three-dimensional promotion of multidimensional promotion is proposed to promote the symbiotic development of mechanical and electrical integration professional chain and regional industrial chain, thus high-quality composite skilled talents serving the large scale customized production and service demand of regional industrial chain are cultivated.

1. Introduction

The Made in China 2025 has clearly put forward a strategic development line focusing on the promotion of smart manufacturing, while focusing on "smart manufacturing engineering" and "green manufacturing engineering", full implementation of smart manufacturing and green manufacturing. In January 2019, the State Council issued the National Plan for the implementation of the reform of vocational education, which states that "to promote the integration of industry, education, schools and enterprises, and dual education", so vocational schools have started to actively explore models to serve regional economic and social development, with a view to resolving the industrial chain, professional chain, talent chain, innovation chain (abbreviated: four chain) synergy integration.

2. Analysis of the current situation of vocational education

Many other developed countries such as Germany, Japan, the United States and etc. attach great importance to vocational education. The secret weapon of Germany's economic boom was the German dual system of vocational education, in which the entire training process was carried out in factory enterprises and in state vocational schools, and the mode of education was mainly enterprise training, practice in enterprises and theory teaching in vocational schools are closely combined [1]. The "three-way" co-operation mechanism set up by the Swiss vocational education has kept it at the top of the global economic competitiveness rankings for many years [2]. Vocational Education in Australia ensures that schools are always market-oriented and meet market demand [3].

The higher vocational colleges in China have made a series of achievements in the construction and reform of professional chain by using the advanced experience of foreign vocational education for reference and combining with the situation of our country. Chang Chen and Wang Benliang explored and studied the "three types and one type" training mode of "building factory-style College, Running industrial-style specialty, developing technical courses and cultivating applied talents", three different ways provide the platform for the integration of different functions of school and Enterprise [4]. The paper [5] studies the logic and mode of constructing the characteristic industry

college which integrates the cultivation of talents, technological research and development and social service. The interdisciplinary and professional integration is promoted to cultivate new professional growth and to innovate school-enterprise cooperation model [6-7]. The upgrading of the equipment manufacturing industry and the adjustment of the economic structure has been accelerating. Compared with the developed countries and with the requirements of building a modern economic system and building a strong country in education, there are still some problems in vocational education in China, such as the imperfect system construction, the imperfect system standard, the lack of motive force for enterprises to participate in running schools, and the lack of supporting policies for the growth of technical talents. The mechatronics engineering professional chain is facing such a major industry transformation and upgrading. Lack of strong support from industry enterprises or communities, the integration of industry and education enterprises are still under cultivation. The path of other countries is not yet learned.

The modern manufacturing industry continues to integrate with the industrial Internet and big data and so on, but at present the construction of professional chain is not closely linked with the industrial chain, the co-cultivation of talents is lacked, in-depth cooperation between schools and enterprises is lacked. The mechatronics engineering chains of vocational colleges across the country, which rely on the intelligent manufacturing industrial chain, urgently need to keep up with the pace of this round of industry transformation and upgrading, find business partners, jointly deepen the reform of the professional chain, and adjust the positioning of the professional chain in a timely manner. The chains need to bring new technologies, new techniques and new norms into the teaching standards and content, formulate talent-training programs that are compatible with new technologies such as artificial intelligence and industrial internet, and develop suitable course systems and teach quality evaluation systems, it should be equipped with the necessary teaching conditions both inside and outside the school and the full-time and part-time teaching staff, so as to cultivate high-quality workers and technical talents in time and serve the needs of regional economic and social development for industrial upgrading.

3. Key points and difficulties of four chain connection of mechatronics

The development of the intelligent manufacturing industry chain has made the structure of the mechatronics engineering, the orientation of each specialty and the training mode of talents unsuitable. The major setting of higher vocational education was once influenced by "inter-industry division of labor", and was set up according to industry category under the framework of primary, secondary and tertiary industries. Therefore, enterprises require high professional skills and low labor prices for talents in front-line positions relatively. However, with the progress of science and technology and the intensification of competition, there has been an intra-industry division of labor, the post of talent levels, structure, specifications and ability quality requirements of differentiation.

3.1 The construction of the mechatronics engineering professional training community urgently needs to realize the integration of industry and education in the aspect of theoretical research.

Through in-depth investigation and research, the specific requirements of the development of industrial chain for the construction of professional chain are carefully analysed. Guided by the educational theories of "the view of great engineering ", "engineering integration teaching", and cooperative education, etc., this paper studies the essential connotation, internal structure requirements and the relationship among the course combinations of the professional chain connecting the industrial chain under the new normal. This paper also studies the relationship between professional chain and industrial chain, teaching organization and production service organization, school interest and enterprise interest, curriculum combination and job practice, etc. Thus a new idea of reconstructing the professional group into a new type of professional chain and breaking through the barrier between the four chains is put forward, it can effectively guide the reform and development of specialty chain and construct the new idea of talent training community to ensure the long-term development of specialty chain.

3.2 The construction of the mechatronics engineering professional training community urgently needs the construction of the mechatronics engineering professional chain linking the industrial chain.

Starting from the selection of a typical enterprise representing the development direction and level of mass customization production and service in the regional mechatronics engineering industry chain, according to the development needs of the regional industry chain and the requirements of cultivating people by virtue, the university and the enterprise will work together to formulate the reconstruction plan of the professional chain, which is composed of the existing mechatronics engineering, electrical automation, intelligent control and numerical control technology, and break the framework of "institute-school-department-specialty", the typical enterprises in the industrial chain initiated by the school set up the "industrial college of mechatronics". According to the new normal requirements of the development of the enterprise chain, cross-border integration of resources, and taking the promotion of the industrial chain in the service area as the main line, a number of curriculum combination of a new professional chain is to be established to serve the regional industrial chain out of the traditional "specialty" and "professional group" concept.

3.3 The difficulty of the four-chain connection lies in the form of cooperation and the connotation of the integration of industry and education at present.

Due to the lack of theoretical guidance on cooperative education, the lack of understanding of cooperative education by enterprises, the lack of effective measures by schools, and the low efficiency circulation of shallow level cooperation and deep integration between schools and enterprises, it is still difficult to achieve deep integration of industry and education, and it is difficult to implement vocational education in a wide and long-term way. The "courtyard of the academy" and the "order class" jointly built by the school and the enterprise are also unable to develop rapidly due to the change of the enterprise's employment plan and the adjustment of the internal structure. It is urgent for the integration and innovation of industry and education to realize the rapid development of the professional system which is symbiotic with the industrial chain. The realization of the professional system symbiosis with the industrial chain requires the integration and innovation of industry and education. Based on the achievements and resource accumulation of previous school enterprise cooperation methods, the difficulties and pain points of industrial chain, professional chain, innovation chain and talent chain are systematically studied, the common interests are explored, the effective mechanism to maximize the interests of schools and enterprises and the effective carrier to promote the continuous and in-depth integration of industry and education are studied, and the "four chain interconnection, intelligent coordination, multiple interconnection and three-dimensional promotion" is constructed. The solution of the deep integration system of industry and education based on the three-dimensional and multi-dimensional talent training community has opened up a new path of four chains' long-term symbiotic development.

4. The talent training community of "four-chain interworking, intelligence cooperation, multiple interconnections and three-dimensional advancement" are constructed.

Taking the major of mechatronics technology, intelligent control technology, industrial robot technology, electrical automation technology, refrigeration and air conditioning technology as samples, and combining with typical enterprises representing the direction of regional economic development, we have formed a talent training community, jointly adjusted the professional positioning, reformed the training objectives, training modes, teaching methods and assessment methods, and cultivated applicable talents serve the corresponding links of "product personalized design - large-scale manufacturing - system integration - intelligent logistics - product marketing - all-round technical support services" in the industrial chain to boost the development of regional industrial chain.

4.1 Top level design

In view of the common problems existing in higher vocational specialties such as the separation of the four chains, the lack of close integration of specialties and industries, the lack of innovative ability of talents and the large gap between the needs of enterprises, etc., the industrial chain of research, design, manufacturing and large-scale personalized service of regional mechatronics products should be connected, and the structure of the professional chain reconstruction of mechatronics and the construction of talent training community based on the deep integration of industry and education should be carried out. Starting from the selection of typical enterprises representing the development direction of regional industrial chain, the university and enterprise jointly build the "industrial college of mechatronics" educational platform. At the same time, based on the upgrading, transformation and optimization of regional manufacturing industry, with talent training, technical training, technology transfer and joint development projects as the main carrier, a long-term mechanism of deep integration of industry and education will be established, and a multi-dimensional talent training community of "four-chain connectivity, intelligent coordination, multiple interconnection, and three-dimensional promotion" will be built. So a new talent training ecosystem will be formed to enrich and develop the theory of industry education integration, to promote the symbiotic development of the electromechanical integration professional chain and the regional industrial chain, and to cultivate high-quality composite skilled talents serving the large-scale personalized production and service demand of the regional industrial chain." The structure chart of talent training community is shown in Figure 1.

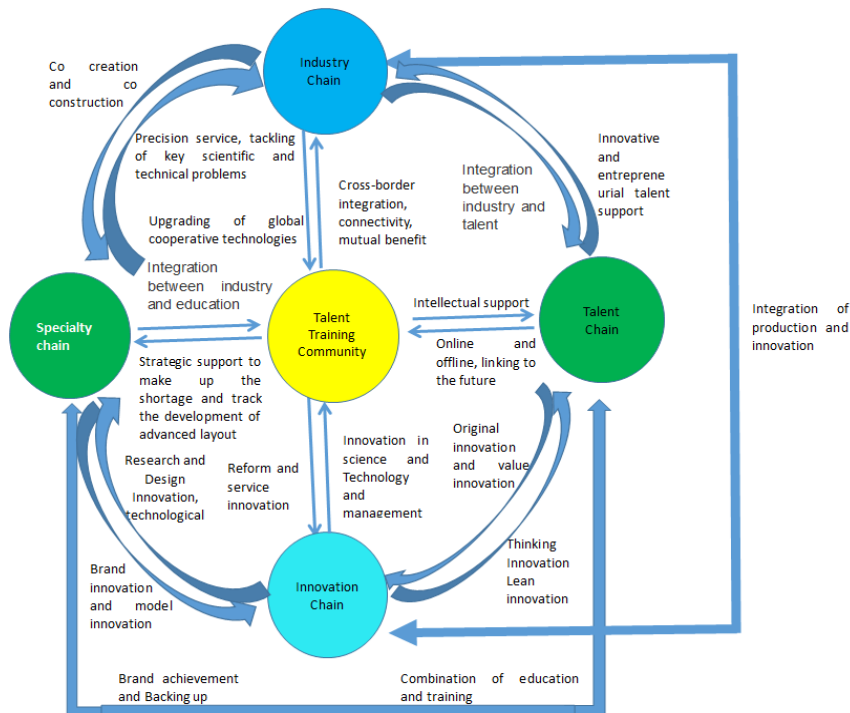


Figure 1 Structure chart of talent training community

4.2 Accurate location

Taking the reconstruction of the existing specialties of the college as the professional chain corresponding to the industrial chain, and selecting the typical enterprises, according to the specific social, methodological and professional capabilities of the work and action fields for which the required talents are oriented. Therefore, we can determine the training orientation of the professional chain and the training orientation of each specialties, design the learning field and learning situation of each specialties, formulate the specific progressive three-year student career design and career development design. According to this, we will provide full-time and part-time teachers, training conditions inside and outside the school, the development of teaching materials, on-line and off-line resources development and personnel training mode, innovative ideas of

teaching mode to serve the regional economic and social development.

Based on the methods of system theory, cybernetics and information theory, the integration of man-machine and man-net is achieved to realize the integration of information, knowledge and intelligence. We will deeply analyze the path method and implementation scheme of the whole process of talent training, and construct the operation mechanism, cooperation mode and dynamic updating mechanism of talent training community to optimize the professional system.

4.3 Implementation path

4.3.1 Investigation and cluster analysis

Through the existing basic research, literature review, questionnaire survey, enterprise investigation, according to certain rules to cluster, the problems in the current construction of professional chain will be summed up, the difficulties and pain points of the industrial chain, the professional chain, the talent chain and the innovation chain will be analyzed, and the common interest points will be excavated. In order to find the breakthrough point for the deep integration of industry and education, the typical enterprises in the chain will be selected, the core layer, backbone layer, cooperation layer of enterprises and cooperation colleges of professional (group) chain of talent training community based on the platform of industrial college will be built to provide a basis.

4.3.2 Select the typical enterprises that represent the development direction and level of regional industrial chain.

In order to analyze the characteristics of industrial chain and the demand of mechanical and electrical industry in Shandong Province, the status quo and problems of job correlation, technical skill intercommunication and the integration mechanism of industry and education, the preset questions were set up, and the questionnaire was made through visiting schools, enterprises, research platforms, industry associations, and so on. The purpose is to further tap the needs of banks and enterprises, explore the school-enterprise cooperation model of mutual benefit and feasible ways and means. Based on the previous research and cooperation practice, the preliminary selection has already had a high impact on the regional mechatronics engineering industry chain, and has formed its own characteristics and good prospects in mass customization and service upgrading. The product and service range span all major links of the mechatronics industry chain, and the target customers cover all levels of consumer groups. On the basis of cluster analysis and further research, with expanding the scope of selection and further optimization, the core circle of talent training community of "multiple interconnection and three-dimensional promotion" will be built.

4.3.3 Build "industrial college" education and training platform to establish a curriculum combination for the characteristics of the professional chain.

Learning from the "dual system" and other models, we summarized the apprenticeship pilot experience, deepened the integration of industry and education, school enterprise cooperation, and improved the diversified pattern of education. Schools and enterprises worked together to develop talent training programs, and established a new professional chain composed of a number of curriculum combinations, so that each curriculum combination can be positioned in the professional chain and serve the corresponding links of the industrial chain. We will accurately serve the needs of regional development, focus on technological research and development and product upgrading of enterprises especially micro, small and medium enterprises, and strengthen community education and lifelong learning services.

4.3.4 Establish a talent training community with deep integration of Industry and education.

On the basis of the core circle enterprises, the paper analyzes the common interests of the enterprises and the relevant universities in the chain by using the method of fuzzy theory and system method. Several enterprises and universities which share interests will be developed, they can have clear objectives and can realize the path to form the backbone of the community. Thus we will establish a community of enterprises and institutions with the desire to jointly build and share,

and establish a community for the cultivation of talents with deep integration of industry and education based on the interests and demands of each member. As a result, the superior resources across borders will be integrated, and the establishment of a high-level, structured teaching innovation team will be explored in accordance with the characteristics of the chain and the requirements of personnel training and staff training.

4.3.5 Establish a talent training community with deep integration of industry and education.

The educational theory of "Engineering Regression" , such as "the view of great engineering" and "engineering integrated teaching" , is applied in the practice of reconstructing the professional system of higher vocational education, breaking through the traditional concept category of "specialty" and "specialty group", the idea of constructing professional systems and platforms, such as "industrial colleges" jointly established by schools and typical enterprises in the industrial chain, and professional chains characterized by the combination of courses in each link of the industrial chain. This paper reveals the essential connotation, the internal structure requirements, the relationship and the development law of the professional chain connecting the industrial chain under the new normal, and the integration of industry and education under the guidance of the classical cooperative education theory. It also enriches and develops the theory of school-enterprise cooperation, work-study combination in higher vocational education, by breaking through the thinking pattern of over-reliance on "government leading and industry leading". It still reveals the relations between professional chain and industrial chain, teaching organization and production service organization, school benefit and enterprise benefit, course combination and job practice, and systematically puts forward the solution to break through the barrier between the four chains to ensure the rapid development of the professional chain.

5. Conclusion

To summarize and improve the achievements of the past cooperation platform between colleges and universities, to break the framework of "colleges-departments-specialities", and to break through the traditional professional system in which disciplines are mainly related, the school and the typical enterprise on the industrial chain jointly build the "Industrial College" , the professional chain and the professional platform construction paradigm, which is characterized by the curriculum combination of the links of the industrial chain, starting with the selection of typical enterprises representing the development direction and level of the regional industrial chain, in accordance with the development needs of the regional industrial chain and the requirements of establishing moral people, relying on the industrial chain to establish a platform for cooperation in running schools, and in accordance with the new professional concept, in response to the corresponding links in the industrial chain, the orientation of specialty has been redefined, the integration of specialty creation, the construction of quality education carriers such as curriculum ideological and political education have been strengthened, and the high-quality resources in and outside the school have been integrated. The four-chain cooperation and integration will open up a new way for the development of professional chain, industrial chain, innovation chain and talent chain, and cultivate talents with compound skills to meet the demand of industrial chain upgrading and serve regional economic and social development.

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