A study on the path of teacher team building for training field engineers based on symbiosis theory

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Abstract: China proposes to cultivate 200,000 field engineers by 2025, and clearly points out that it is necessary cultivate a team of high-quality technical and skilled talents who are "proficient in operation, have indepth understanding of processes, possess management skills, capable of collaboration, and be able to innovate". The core of the cultivation lies in deepening the integration of industry and education, school-enterprise cooperation, and deepening and expanding the existing apprenticeship cultivation model.

The core of its training mode lies in deepening the integration of industry and education, deepening the school-enterprise cooperation, and expanding the existing apprenticeship training mode. It has been proved that the main constraint to the realisation of the above goal is that a team of qualified teachers has not yet been established. In order to solve this problem, this paper starts from China's national vocational education field engineer training programme, applies symbiosis theory to vocational education research, further optimizes China's existing apprenticeship training model, builds a triangular structural model of structured teacher teams for field engineers, and eventually forms a mutually beneficial and win-win collaboration model for all stakeholders to solve the problem of building the required teacher teams for field engineers' training. The final result is a mutually beneficial collaborative model for all stakeholders.

1.INTRODUCTION

In September 2022, China's Ministry of Education and four other departments issued a special training programme for the implementation of vocational education field engineers[1], with the objectives of the programme clearly stating that by 2025, a total of no less than 500 vocational colleges and universities and 1,000 enterprises will take part in the programme, and a total of no less than 200,000 field engineers will be trained. The programme includes four key tasks, as the joint implementation of apprenticeship training by schools and enterprises, the promotion of the reform of admission examination and evaluation, the creation of a structure dual-teachers team, and improve the digital skills of employees. The programme is a response to the demand for talents in key areas such as advanced manufacturing, strategic emerging industries and other industries, following the Communist Party of China (CPC)'s 20th National Congress report, which proposed to "promote the integration of vocational education and general education, the integration of industry and education, the integration of science and education, and optimise the positioning of the vocational education as a type education," as well as the inclusion of the "implementation of apprenticeships with Chinese characteristics" in the new version of the Vocational Education Law. After the inclusion of "implementation of apprenticeship system with Chinese characteristics" in the new version of the Vocational Education Law, it is another top-level design to further deepen the apprenticeship system with Chinese characteristics in response to the demand for talents in key fields such as advanced manufacturing industries and strategic emerging industries.

Creating a dual-teachers team is one of the four key tasks, and is also the key to the completion of the programme. How to train a large number of "master craftsmen" who have the ability to teach and educate people, engineering thinking, technical innovation and curriculum development, and who are able to solve on-site problems in the field of engineering, is the most important task in the implementation of the "special training programme". The construction of China's dual-teachers team has gone through a long development process, and the definition of dual-teachers has been gradually clarified, from the "dual certificate", "dual title", "dual ability and dual quality", "dual structure", and various superimpositions of these elements [2], as well as the fact that "dual-teacher" are not for individual teachers, but rather for teachers team who are "dual-teacher"[3], the team built by "theoretical teachers+practical teachers". Drawing on German case studies, the dual training of teachers in both teaching and work positions provides a
metaphor for their own professional knowledge. And the change workshop provides a potential mechanism for enhancing personal competencies. In 2022, the Ministry of Education issued a new vocational education "dual-teacher" identification standards to achieve unity, only with both theoretical and practical teaching ability, closely follow the development of industry practice content, with industry-related work experience to obtain the "dual-teacher" qualification.

Although the definition of dual-teacher is constantly being clarified, there are still many problems with dual-teacher training and team building in practice. In particular, the number of dual-teachers is insufficient, most teachers in vocational education institutions lack practical experience in the industry and teaching methods and abilities. There are practical obstacles to developing technical masters in enterprises to enter vocational education institutions to teach directly. Meanwhile, large discrepancy exists between the full-time teachers in vocational education institutions and the teachers came from industrial enterprises, both of them have different ideas and methods of preaching and teaching, no matter from the work experience, educational background, or to preach and teach. It is difficult for teachers of vocational institutions to break the conventional mode and solidify their disciplinary thinking. The problems of improving the number of dual-teachers and the synergy between school and enterprise mentors need to be solved urgently.

2. The Path of Dual Teacher Team Building Based on Symbiosis Theory

2.1. Symbiosis theory and its application in the field of vocational education

Anton de Bary, a German mycologist, proposed the Symbiosis Theory in 1879 to describe the state of living together of organisms of different species based on certain material connections. He believed that symbiosis is a kind of self-organization phenomenon, and that organisms have to depend on each other and interact with each other in a certain way to form a symbiotic relationship of coexistence and co-evolution. Since then, the theory of symbiosis has been used as a methodology in other fields, where various stakeholder relationships are systematically analyzed and considered as symbioses.

Symbiosis (symbiotic system) mainly consists of three elements, symbiotic unit, symbiotic mode and symbiotic environment, any symbiosis is the result of the common combination of these three elements and interaction. The general trend and direction of development between symbiotic units is co-evolutionary in accordance with a certain inevitable connection to form a symbiosis, and in accordance with the inherent requirements of the formation of symbiotic patterns and in the process of symbiotic evolution of new energy (symbiotic energy), symbiosis for the symbiotic unit to provide the ideal path of evolution, which makes the symbiotic unit in the mutual incentives to co-evolution.

The main way of obtaining symbiotic energy is the rational division of labour between symbiotic units, which are "working together" (Zaccaro & Horn, 2003), and have symbiotic units that benefit from their interactions to produce "symbiotic performance" (i.e., symbiotic energy). Symbiotic units benefit from their interactions to produce "symbiotic performance" (i.e., symbiotic energy), and a special structure is formed between symbiotic units to adapt to changes in the external environment (Moor, 1993).

The characteristics and orientation of vocational education and its type of education determine the ability of the symbiosis theory to be transplanted and applied to solve the problem of adaptation of vocational education.

2.2. Analysis of the Dual-Teacher Team Mode for Field Engineer Training Based on Symbiosis Theory

The symbiotic unit of dual-teacher team construction for field engineer training mainly includes vocational colleges, enterprises and industry associations. Vocational colleges and enterprises are directly involved in the construction of teacher teams. Industry associations and other organisations participate in the governance of modern vocational education in three basic forms: decision-making and consulting, governance of modern vocational education in three basic forms: decision-making and consulting, management and service. They are more capable of mobilising the resources of industries and enterprises involved in the construction of dual-teachers' teams.

The symbiotic environment has a very important influence on the symbiotic system. The "Field Engineer Special Cultivation Programme" is innovative in the design of dual-teacher team building, and the policy issuers include not only the Ministry of Education, which has jurisdiction over vocational colleges and universities, but also the authorities in charge of enterprises in different industries, and the Chinese Academy of Engineering, which represents the highest level of research in the manufacturing industry. It provides a good institutional support for the construction of dual-teacher teams, and at the same time gives considerable support in terms of law and taxation. Continuous improvement of the symbiotic environment occurred.

At present, the symbiotic unit organisational model of Chinese vocational education teachers is mostly point symbiosis and intermittent symbiosis, and the behavioural symbiosis model is mostly biased symbiosis or non-moulding reciprocal symbiosis. By changing the external symbiotic environment and through various incentives, the "Field Engineer Special Training Program" promotes the transformation of the organisational model of each symbiotic unit from point and intermittent symbiosis to continuous and integrated symbiosis, and the transformation of the behavioural model from biased symbiosis and asymmetric reciprocal symbiosis to symmetric reciprocal symbiosis (Figure 1).
Dual-teachers team building for training field engineers should be guided by the school-enterprise-industry triangular symbiosis model to establish a collaborative education community. Continuous symbiosis and integrated symbiosis model requires that each symbiosis unit should realise the integrality of technology complementarity, product supply and demand, and business module combination among subjects, with value co-creation as the basic premise; meanwhile, attention should be paid to the interactivity of material and energy, and the coordination of quantity, quality, form mode and function\[9\]. Symmetric reciprocity mode in different symbiotic units not only mutual flow of resources, complementary, and can be based on their respective advantages division of labour to carry out cooperation, resulting in energy flow and the generation of new energy, in the symbiotic unit on demand, that is, different symbiotic unit needs are effectively met\[10\]. As a result, its symbiosis mode must rely on the physical operation of the Institute of Field Engineers, aggregating the resources of the government, schools, enterprises, industrial parks, industries and expert organisations to form an organically unified and flexibly articulated community. The government contributes policies, funds and mechanisms to form a favourable symbiotic environment, and schools and enterprises build the College of Field Engineers, improve the mechanism of school-enterprise and inter-school collaboration, and promote the "three combinations", i.e., the combination of professional settings and industrial needs, the combination of curriculum content and industry standards, and the combination of teaching process and production process. Industry associations, on the other hand, have gathered industry elites such as the National Teaching Guidance Committee, experts from the Chinese Academy of Sciences and the business sector, and senior engineers to further supplement the faculty of vocational colleges and universities, and participate in the training of on-site engineers in the capacity of part-time instructors. With the support of multiple forces, schools, enterprises and industry teachers are tightly bound together to jointly carry out teaching organisation, digital resource development, textbook writing, and research on horizontal topics of enterprises, etc. Excellent field engineers are trained to enter the industry and work in enterprises, and then rejoin the training of field engineers in the capacity of teachers after their growth, thus forming the flow of energy and the distribution of energy according to the needs, and thus achieving a win-win situation with mutual benefits(Figure 2).
3. Conclusion

Using the symbiosis theory to analyse the current situation of the construction of dual-teacher teaching force in China, it can be seen that schools, enterprises and industries are still in the lower stage of the symbiosis construction, and it is necessary for the symbiosis units to continue to push forward vigorously. The proposal of "Field Engineer Special Training Programme" puts forward higher requirements for the construction of dual-teacher teaching team, but also provides a better symbiotic environment, and the dual-teacher team should be established in accordance with the school-enterprise-industry triangular symbiosis model. It should be noted that the differences in the levels of vocational colleges and their own characteristics determine that when building a dual-teacher team, they must combine their own characteristics, define their own positioning in the overall symbiosis of dual-teacher team building, give full play to their own advantages, and take the road of characteristic development.

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References