

New Engineering Education and Teachers' Development in University

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Abstract—The construction of new engineering education system is a significant strategic decision and deployment for making higher engineering education to adapt to the new era of economy and industry. Based on the connotation of new engineering and the new requirements of the teaching team, this paper proposes an open and adaptive four-dimensional integrated training system through integrating production and education, discipline, science and education, innovation and entrepreneurship. With this proposed integrated four-dimensional system, the incompatibilities between education and industrial demands can be effectively eliminated.

Keywords—new engineering, teaching staff construction, four-dimensional integration

I. INTRODUCTION

This article examines the connotation characteristics of “new engineering”, and forwards a series of “new” requirements and new challenges to the faculty team in accordance with the requirements of the “new engineering” construction. The “new” requirements are mainly focused on the knowledge and the industrial experience of teachers [1]. The teacher has the ability to integrate the development and scientific research of an industry. At present, the training method of the teaching staff cannot meet the needs of the university for the training of “new engineering” talents, and exposes many problems. Teachers are lack of the reform and innovation teaching strategies and teaching methods, lack of the incentive mechanism for the cultivation of university teachers' engineering practice ability, the obstacles of the interaction mechanism, the internal motivation of the school in the implementation of “innovation and entrepreneurship”. How can the school effectively tackle the shortcomings of the existing training system through effective training, and form a high-synchronization, deep integration, and multi-dimensional cooperation of the university teachers? It is an open question.

II. DEFINITION AND REQUIREMENTS

In the national innovation drive development, “One Belt

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Fund Project: the authors wish to acknowledge the financial support of Research Project of Zhejiang Provincial Education Department (Grant No. Y201839871).

and One Road”, “Made in China 2025”, “Internet +” and other major strategic background, with new technologies, new forms and new model and new industry represented by the new economy booming, the ministry of education puts forward new engineering construction, is an urgent need to engineering education to speed up the reform and innovation, realize the upgrade in China's higher education as a whole [2]. Guidance documents such as “Fudan Consensus”, “Tianda Action” and “Beijing Guide” clarify that “new engineering” is the setting and development of new economy, new industries such as artificial intelligence, robotics, intelligent manufacturing, cloud computing, etc. Some new engineering majors also include upgrades and transformations to traditional engineering majors. Compared with traditional engineering, “new engineering” emphasizes the practicality, cross-cutting and comprehensiveness of disciplines, with particular emphasis on the close integration of new technologies with traditional industrial technologies [3].

According to the connotation and characteristics of new engineering, teachers are required to have a broad range of knowledge. They should not only pay attention to their own disciplines, but also pay attention to emerging disciplines, interdisciplinary disciplines and frontier disciplines, especially new technologies and new industries related to their disciplines. To master the basic operation methods of advanced engineering equipment, have the industrial experience of solving all kinds of cutting-edge problems, and maintain close cooperation with the industry; the ability to develop and innovate industries and apply multidisciplinary knowledge, principles and methods to solve complex engineering problems, as well as to meet challenges and deal with future problems; engineering education concept, education and teaching ability, practical teaching ability, but also pay attention to the “Internet +” platform and the application of information technology.

III. PROBLEMS

As the main participant and executor of new engineering construction, college teachers are far away from the requirements of new engineering construction. There are four main aspects in the analysis of existing problems and current situation analysis: first, most of the teacher education theory is not solid, the innovation power is insufficient. New engineering construction requires teachers to innovate in teaching strategies and methods.

Generally speaking, young engineering teachers have not received systematic learning from teachers' majors and have only summarized teaching experience from work practice, which is difficult to make up for the shortcomings of weak educational theories. Therefore, it is difficult for most teachers to put forward significant teaching strategy reform. Secondly, the training of engineering practice ability of college teachers lacks incentive mechanism. At present, most schools in China tend to give priority to academic achievements, scientific research projects and academic papers. The threshold of the new industry field is high, the early investment is big and the return is small, there is no corresponding incentive mechanism, and the willingness of teachers to participate is low. Thirdly, the school-enterprise interaction mechanism cannot meet the needs of talent cultivation and collaborative innovation under the background of new engineering. College teachers lack engineering practice opportunities in the new industry field. The education mode of teachers in undergraduate and postgraduate stage is characterized by "attaching more importance to theory than practice", ignoring the intellectual flow and resource sharing of enterprises [4]. Finally, due to the lack of internal motivation for the implementation of "innovation and practice" integration, teachers' innovation and practice education still lingers at a low level and is difficult to be implemented, including ideas and atmosphere, resources and platforms, teachers and experience, etc. "Innovation and practice" brings economic and social returns, and it is difficult to provide good self-hematopoietic function for the innovation and sustainable development of application-oriented universities [5].

Compared with the basic characteristics of new industry and requirements of new engineering teachers, the main deficiency of the existing training system of application-oriented undergraduate colleges lies in the insufficiency of industry-oriented openness and integration, and the insufficiency of adaptability and support.

First of all, the orientation and connotation of school development do not meet the needs of national economic development strategy and industrial development. The sense of mission and initiative to serve the country's economic development and the strategy of strengthening the country is not enough [6]. It cannot face the main economic battlefield in time, integrate into the core needs and frontier areas of economic and industrial development, serve the transformation and upgrading of emerging industries and traditional industries, and adjust the strategic awareness and planning of the orientation and connotation of school development and lack of motivation of action.

Secondly, the training goal of the teachers is not suitable for the development of the industry. It is not susceptible to industrial development and major changes, unable to capture and study the new trend timely and effectively, new characteristics and new needs of industrial development, and based on this research and judgment, adjust and improve the training objectives of talents, and timely

deploy the strategic docking between teacher training and industrial development.

Thirdly, the school-enterprise interaction mechanism cannot meet the needs of teacher training and collaborative innovation under the background of new engineering. Mechanisms for resource sharing, information sharing, coordinated development and win-win cooperation need to be strengthened. The mechanism and system of integrating high-quality industrial resources into talent cultivation in colleges and universities and integrating intellectual resources into industrial innovation and entrepreneurship need to be further strengthened and activated.

Fourthly, discipline construction and scientific research activities cannot effectively meet industrial needs and feedback talent cultivation. Discipline construction and industrial development areas of significant strategic direction or disconnect, docking industry forefront of new or existing subject construction discipline of lag and fusion, research on production of industry technological innovation needs, quite a proportion of the scientific research and its output by a teacher job title promotion or employment system has not been effective form, has nothing to do with national development strategy, regional industrial upgrading, also irrelevant personnel training. Performance or quality evaluation on running a school, stay in based on the impact factor assessment mechanism of scientific paper social development services in the ability in colleges and universities, serving the industry enterprise technical progress ability, the ability to create value for the learners as its core based on the evaluation system has not really formed.

Fifthly, the training mechanism cannot effectively support the achievement of talent training objectives under the background of new engineering. Relying on the secondary colleges set up by the traditional discipline division, the awareness of boundary is too strong, and it is difficult to adapt to the resource sharing, intelligence coordination and talent training between interdisciplinary and college. In terms of personnel policy, it is not conducive to guiding teachers to engage in high-quality teaching and scientific research with service industry development and talent cultivation as their own responsibility, and it is not conducive to the sharing of intellectual resources and two-way flow of personnel between universities and industries [7]. In terms of discipline and scientific research policy, it is necessary to further emphasize the demand orientation of industrial strategy development and innovation, as well as the orientation of talent cultivation.

IV. RESULT

The cultivation of new engineering teachers in colleges and universities must be based on the openness, integration and innovation of culture system, the need to rely on "four fusion", namely the discipline integration, science and education fusion, the fusion production and education, double gen fusion based on mechanism and system

innovation, break the shortcomings of existing talent team, build a highly open, depth fusion, multiple coordinated and effective to adapt to the teaching staff in colleges and universities cultivate ecological system [8].

Discipline integration, not only about the importance of the teaching staff training to improve, and the discipline integration than ever to expand the breadth and depth, is the new engineering basic guarantee for the construction of teachers' team, not only the new engineering talent training, the teachers and students of the new engineering system of innovation and entrepreneurship practice also cannot be separated from its support, it is to promote science and education integration, double integration, realize the depth of the integration of production and education lubricants and adhesives. The basic starting point and standpoint of subject integration is to promote the integration of industry and education, science and education, innovation and innovation, and support the training of new engineering talents. It must be oriented by the needs of new engineering talents training and driven by the needs of scientific and technological innovation for new industries, and implement the cross and dynamic integration on demand. To take the innovation and entrepreneurship activities supported by the integration of disciplines as an example, it is necessary to integrate human and material resources from different disciplinary backgrounds and establish an interdisciplinary innovation and entrepreneurship team or platform centering on the innovation needs or entrepreneurship theme.

The integration of science and education is the breakthrough of the construction of new engineering teachers and the catalyst of the integration of industry and education. The first is the integration of scientific research and teachers' "teaching"; the second is the combination of scientific research and students' "learning". The integration of scientific research and students' "learning" can stimulate students' passion and desire for innovation, cultivate their sense of mission and value for innovation, and stimulate and cultivate students' innovative thinking ability [9].

Firstly, the quality, connotation and value of teachers' scientific research should be improved to make teachers change from the passive scientific research oriented by promotion and post recruitment to the active scientific research oriented by industrial innovation demand. Combining with teachers' own scientific research orientation, specialty and interest, the theoretical research and production of engineering technology are realized.

Secondly, teachers' ability to analyze, predict and judge industrial development and to interact and communicate with the industry should be improved. Changing from a bystander of industrial innovation to a participant is conducive to teachers' forward-looking prediction, keen capture and accurate judgment of industrial development trend and talent demand change, and on this basis, professional setting, cultivation target positioning and curriculum teaching system planning for meeting industrial demand can be realized [10]. It is beneficial for teachers to deeply understand and grasp the hot and difficult points of

industrial development, integrate into the industrial discourse system, and realize more smooth and effective school-enterprise communication and production-teaching integration.

Thirdly, teachers' knowledge, ability and quality should be continuously updated or improved, and teaching resources should be expanded. Teachers in self-improvement at the same time, through the research to the industry of new ideas and new knowledge, new technology and new method is brought into the classroom, teaching material and laboratory: or can rely on the science and technology projects and obtained funds resources, use of science and technology innovation platform for students' innovative undertaking education support, achieve substantial scientific research and teaching feedback [11].

Fusion Manufacturing is a new engineering construction of teachers team leader, relying on the integration, production and education can be established between industry and universities based on the information of the cooperative education and innovation of financing, resource sharing system, to absorb industry enterprise personnel to participate in professional talent training scheme, joint design and planning of professional courses and practical teaching system; make full use of the enterprise's high-quality engineering education resources, including technology and standards, products and solutions, engineering projects and cases, production and service environment, engineering technology and management personnel, etc., to jointly build teaching resources, teaching platform, teaching environment and teaching staff; establishment of training demand and output orientation, industry enterprises to participate in the training quality evaluation mechanism. Establish a technological innovation community serving industrial development [12]. The advantage of discipline in colleges and universities support strong rich intellectual resources, innovation, enterprise's strength is that acute market consciousness, achievements transformation and market development capability is strong, the two sides have complementary advantages, resource sharing, through building engineering innovation center, R&D center, institute of technology innovation, coordinated developing industry and enterprise development strategy research, docking industry development frontier of applied basic research, key areas and the technical innovation and the development of the bottleneck link, for science and technology innovation of industrial incubation, achievements transformation channel and the mechanism of rapid seamless, form the development of win-win synergy innovation platform.

V. CONCLUSION

The integration of innovation and innovation not only further enhances the integration of science and education, but also further enhances the economic and social value of scientific and technological innovation and innovation achievements. To stimulate the internal power of carrying out scientific and technological innovation and

implementing the integration of science and education; Improving teachers' own entrepreneurial wisdom, entrepreneurial ability and entrepreneurial experience, and feeding back into the cultivation of students' innovative entrepreneurial ability and practical guidance of innovation and entrepreneurship, also expand the forms and ways of industry-education integration, which is a higher-level manifestation of industry-education integration and science and education integration. To incorporate the above four measures of construction and the corresponding system and mechanism innovation of existing integrated into a system, the system is not only an industry oriented open system, and realizes the cultivation of talents in colleges and universities, scientific and technological innovation and entrepreneurship practice, social service and so on four big functions, the new engineering and industry development is a dynamic adaptation, is an open, and new industrial development height of the adaptive synchronization of applied undergraduate colleges and universities teachers cultivate ecological system.

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