Exploration of Ways to Cultivate Innovative Talents Aiming at Engineering Maker under the Background of New Engineering

Dongya Yang[a,*], Bin Peng[b], Ziyi Zhang[c], Zhaohui Li[d]

School of Mechanic-Electronic Engineering, Lanzhou University of Technology, Pengjiaping Road, Lanzhou, Gansu, China

[a] yangdy@lut.edu.cn, [b] pengb2000@163.com, [c] 814902346@qq.com, [d] 983105062@qq.com

*Corresponding author

Keywords: Engineering Maker, New Engineering, trinity construction, Maker ecosystem

Abstract: Aiming at the problem of how to effectively train innovative talents under the background of New Engineering, this study takes Engineering Maker as the ultimate cultivation goal. The existing innovation and entrepreneurship practice platform of the university has been effectively upgraded, and the connotation of school-enterprise collaboration has been deepened. On this basis, professional training, enterprise development and innovation and entrepreneurship guidance are carried out in a trinity of reform and innovation, and three key transformations are completed in the collaborative operation of the three in order to create a Maker ecosystem. Then, the various Engineering Maker ecosystems are linked together to achieve ant colony effect, and finally establish an effective way to cultivate innovative talents in the New Engineering era.

1. Introduction

As the reform direction of engineering education in China, the construction of New Engineering disciplines puts forward new requirements for reforming the talent cultivation model, such as strengthening multi-party collaborative education, enhancing multi-disciplinary integration, developing innovation and entrepreneurship education, and cultivating personalized talents. Therefore, the functional orientation of the Engineering Training Centre should actively meet the needs of local economic development and the technological innovation requirements of industries and enterprises, make full use of local and enterprise resources, identify the direction of collaborative education between schools and enterprises, give full play to its own advantages, implement multi-party collaborative education requirements, and build a talent collaborative cultivation mechanism in order to cultivate innovative and entrepreneurial talents that meet the needs of industry development. With the advent of the era of technological innovation, the construction and development of Engineering Training Centre should keep pace with the times. It is not only necessary to cultivate engineering and technological talents who are proficient in their fields, but also to cultivate innovative talents who possess knowledge of multidisciplinary integration and can solve complex engineering problems [1, 2].

At present, the most prominent problem in the cultivation of innovative talents in higher education is the lack of a supporting cultivation system and the lack of in-depth cooperation between industry and academia. In the context of New Engineering disciplines, the cultivation of innovative talents requires the collaboration of university and enterprise, but the current cooperation between the above two still faces problems such as information asymmetry and imperfect cooperation mechanisms. In addition, the cultivation of innovative talents still lacks a systematic training system. Innovative talents need to possess comprehensive abilities in creative thinking, interdisciplinary cooperation, and practical abilities. However, the existing education system in universities focuses more on theoretical knowledge and exam scores, and lacks effective cultivation of innovation and entrepreneurship abilities [3].

Under the background of New Engineering, the cultivation of Engineering Maker is of great significance for promoting college students' innovation and entrepreneurship [4]. It can not only

  DOI: 10.25236/meeit.2024.012

improve college students' innovation awareness and practical ability, help them better adapt to the needs of social development, but also provide more employment and entrepreneurship opportunities for college students, promote their all-round development, and train more innovative talents for the country to promote economic development and improve people's livelihood. Therefore, this paper aims to explore how to build an effective Engineering Maker cultivation system to improve the quality and innovation ability of Makers [5, 6]. This study will help promote the theoretical research and practical exploration of Engineering Maker cultivation, and provide an important reference for improving the training quality and innovation ability of Makers.

2. Ways to Cultivate Engineering Innovative Talent

The cultivation of innovative talents in mechanical engineering cannot be separated from the original innovation and entrepreneurship practice platform of each university. Therefore, how to give full play to the role of the existing platform is very important, and the original platform to upgrade the function and efficiency is imperative. In addition, how to correctly understand the importance of school-enterprise cooperation, to further deepen the connotation of cooperation and enhance the effectiveness of cooperation, it's very important. Based on ensuring effective cooperation between universities and enterprises, further reform and innovation in the trinity of professional training, enterprise development, and innovation and entrepreneurship guidance, to build an ecological environment for the cultivation of Engineering Makers, is the most effective way to address the cultivation of innovative talents under the backdrop of New Engineering.

2.1. Strengthening of the Basic Platform for Cultivating Innovative Talent

Under the background of New Engineering, the cultivation of Engineering Maker is inseparable from the function upgrading and efficiency improvement of the innovation and entrepreneurship basic platform of each university. Therefore, the national experimental teaching demonstration centre of mechanical engineering in our university had been integrated with resources and upgraded with functions, thus forming a hierarchical, modular, and progressive practical innovation teaching system, so that theoretical teaching and practical teaching are closely combined, and practical teaching and scientific and technological innovation are organically integrated.

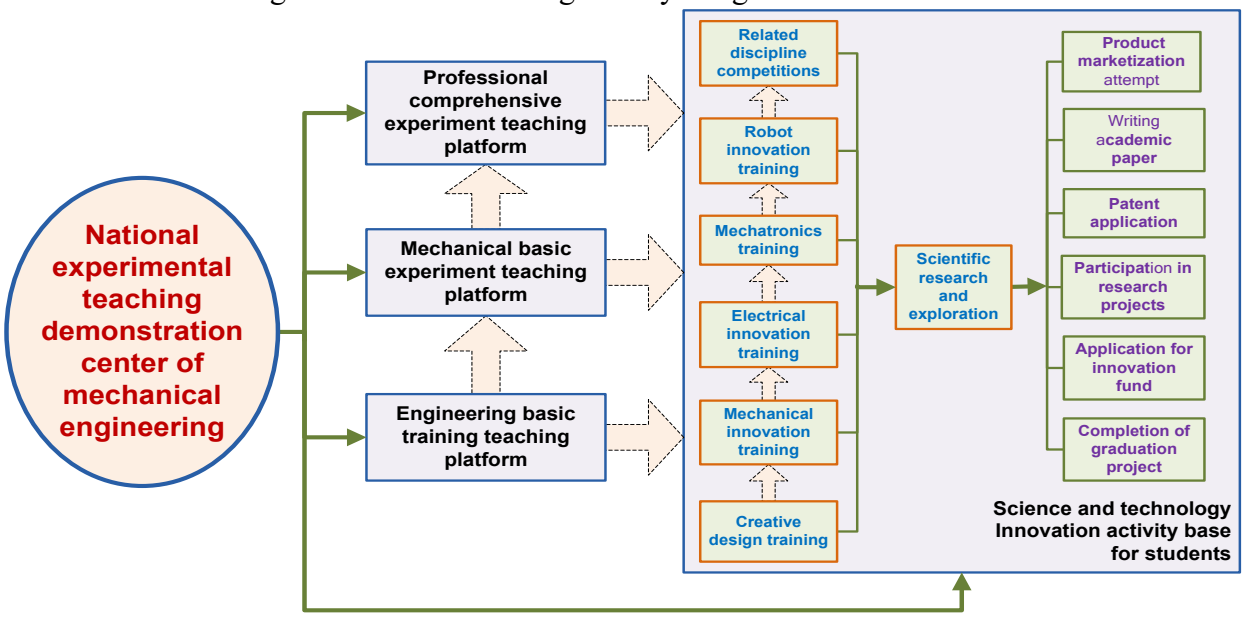

Figure 1 Functional diagram of the upgraded innovation foundation platform.

As shown in Figure 1, the science and technology innovation activity base focus on the cultivation of students' science and technology interest and innovation ability, and provides hardware and software platforms and technical guidance services for science and technology innovation for all students. The upgraded innovation base can effectively carry out creative design, mechanical

innovation design and production, electronic design and production, robot design and other related scientific and technological innovation activities. As can be seen from the Figure, a progressive training mode is formed between each training module.

2.2. Recognising of the Importance of School-Enterprise Collaboration

School is the base for cultivating talents, while enterprise is the stage for talents to display what they have learned. Therefore, school-enterprise cooperation is to build a win-win bridge between universities and enterprises and set up a series of talent training projects through resource sharing. On the one hand, effective school-enterprise cooperation continuously delivers high-quality talents for enterprises, on the other hand, the universities are in line with the market to impart knowledge.

The effective cultivation of engineering makers must deepen the cooperation mode between universities and enterprises, and build a co-construction and co-management talent cultivation mechanism through the integration of production and education. Enterprises and universities jointly cultivate creative talents, so that students can have close contact with front-line business, enterprises can obtain innovative opinions of students, to promote the development of enterprises, and finally form the university-enterprise-student tripartite win-win situation as shown in Figure 2.

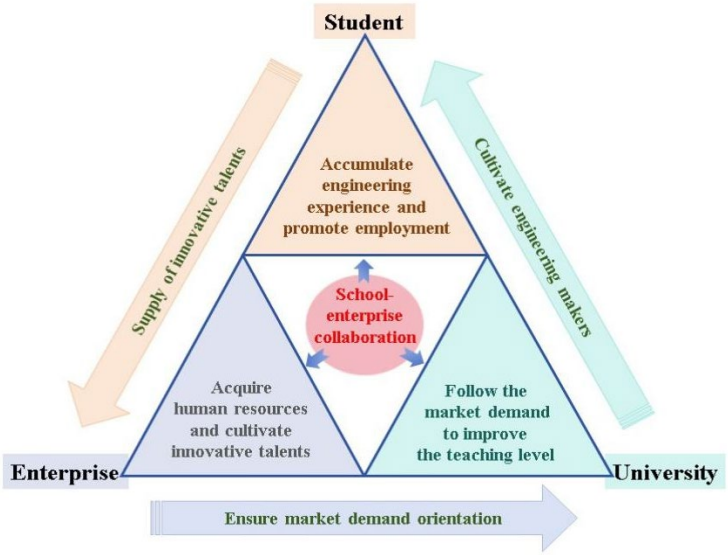

Figure 2 Tripartite win-win relationship diagram.

2.3. Constructing the Cultivation System of Engineering Maker in a Trinity

As shown in Figure 3, under the background of New Engineering, guided by the Internet + innovation consciousness and supported by Internet technology, the innovative research and development of enterprise development, professional cultivation and innovation and entrepreneurship guidance is first completed, and then through three transformations in the process of trinity development, the integration of industry and university is finally realized to build a Maker ecosystem. The specific operation process and implementation steps of Engineering Maker cultivation system are as follows.

First, further deepen the industry-university collaborative innovation mechanism. Based on the existing cooperation, we give full play to the innovation advantages of 'Internet +', and effectively utilize Internet technical means to create a cooperative education mechanism for industry-university integration. We efficiently use 'Internet +' technology to bridge the gap between enterprise production and college and university teaching. Only the university-enterprise communication and collaborative innovation can ensure the efficient production of enterprises and the effective education of universities.

Secondly, make full use of the innovation opportunities of professional construction brought by Internet +, and effectively use the technical means to construct the professional curriculum system in the E era, such as developing dynamic teaching materials, building virtual and real classrooms and training cross-border teachers. Only in this way can innovative talents be output. Universities should

grasp the needs of the era of Internet + professional construction, face the needs of the industry, and jointly explore more diversified and personalized talent training models with enterprises. It is necessary to break the existing boundaries of majors, disciplines, schools and society, and form a cross-border teacher training mechanism that meets the needs of society through collaborative training between universities and enterprises, to accelerate the upgrading of professional training.

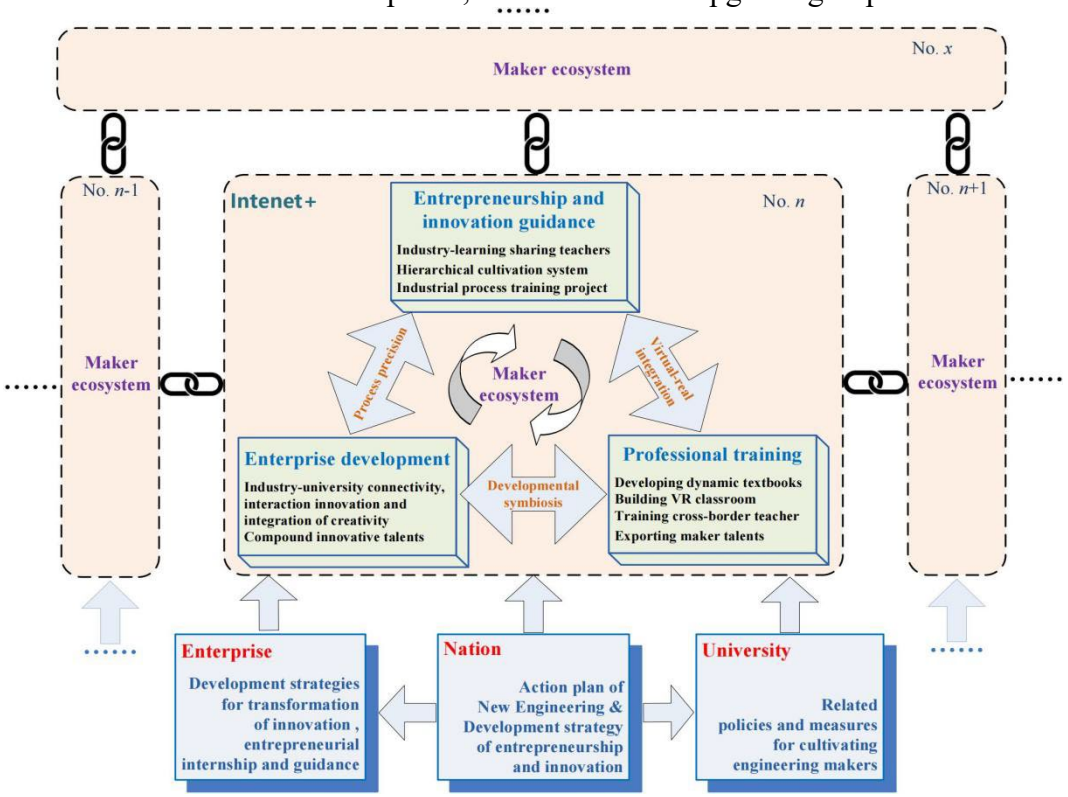

Figure 3 Diagram of trinity cultivation system for Engineering Maker.

Then, based on the innovative reform measures of professional training and school-enterprise cooperation in the Internet + era, a new mechanism for innovation and entrepreneurship education is constructed to realize the double training of teachers and the industrial process of practical projects completely and effectively. The use of Internet technology to ensure the sharing of talents. We organically integrate and make full use of the innovative mentor resources from both universities and enterprises, so that mentors from both sides can give full play to their strengths and jointly establish a dual-mentor mechanism for innovation and innovation cultivation. Based on the actual production and development needs of cooperative enterprises, the engineering practice is taken as the meeting point to effectively promote the industry-university collaborative innovation. In this way, the industrial process of innovation and entrepreneurship practice projects can be realized.

Based on completing the above three innovative reforms, the enterprise development, professional training, and mass innovation education will be carried out in a trinity of collaborative operation. In the process of collaborative operation, three key transformations are completed, namely, developmental symbiosis, process precision and virtual-real integration. The three transformations coexist and grow together in a virtuous cycle, which will eventually form a Maker ecosystem integrating industry and science under the background of New Engineering.

Finally, by efficiently linking and effectively upgrading the Maker ecosystem created by various universities and enterprises, a new model of Engineering Maker cultivation can be built. The remarkable feature of this new model is cross-school cooperation + school-enterprise collaboration + team cooperation. The effective link between each Maker ecosystem can create an ant colony effect, which can not only exponentially increase the basic functions of each Maker cultivation system, but also effectively improve the dimension of China's Engineering Maker cultivation system. The ant colony effect formed by the effective link and efficient operation of Maker ecosystems can accurately establish new solutions to the remaining problems of current engineering education.

3. Conclusion

If higher education wants to cultivate innovative talents effectively, then the innovation and entrepreneurship practice platform owned by universities must be properly equipped. An effective way to properly equip the innovation practice platform is to integrate the resources and upgrade the functions of the national experimental teaching demonstration centre of mechanical engineering. Based on the concept of school-enterprise collaboration, strengthening cooperation, deepening connotation, and upgrading level are not only the premise of building a new model of Engineering Maker cultivation, but also the foundation of university-enterprise-student tripartite win-win situation. Based on school-enterprise cooperation, the innovative reform of professional training, enterprise development, and innovation and entrepreneurship guidance should be completed first. Then, through the trinity of coordinated development and undergoing three transformations in the development process, a new ecology of Makers is created. Next, efficient links and effective enhancement dimensions between each maker ecosystem are carried out, and it is expected to finally establish a new scheme to solve the existing problems in China's engineering education under the background of New Engineering.

Acknowledgements

The research was supported by several projects, which are the teaching research project (GJ2023A-4) of the Institute of Higher Education of Lanzhou University of Technology, the 2023 innovation and entrepreneurship education reform project in Gansu Province, the reaching research project of Virtual Teaching and Research Office of Engineering Maker of Ministry of Education in 2022, and the 2023 college students employment and entrepreneurship ability improvement project of Gansu Provincial Department of Education.

References

[1] Yinling Wang, Xianming Yin, Tao Sun. (2023) Construction of Practice Innovation Platform of Engineering Training Center under the Background of New Engineering. Chinese modern educational equipment, 405, 85-87.

[2] Man Hu, Lihua Cao, Jian Liu, Jianfeng Li. (2021) Exploration and Practice on Construction of Engineering Training Center in University under the Background of New Engineering. Research and Exploration in Laboratory, 40, 154-158.

[3] Tabarés, R., Boni, A. (2023) Maker culture and its potential for STEM education.Int J Technol Des Educ, 33, 241-260.

[4] Aiping Hu, Yecun Song, Quan Chen, Huteng Chen. (2011) Teaching System Investigation for College Graduates Employment and Entrepreneurship. Journal of Jiangsu Teachers University of Technology, 17, 90-94.

[5] Dongya Yang, Zhaohui Li, Hongqin Liu. (2022) Construction and practice of a new model of school-enterprise collaborative innovation and entrepreneurship under the background of Internet +. Gansu Science and Technology, 38, 68-71.

[6] Dongya Yang, Zhaohui Li, Hongqin Liu, Nin Peng, Jiali Zhao. (2021) Exploration of a new mode of collaborative innovation and entrepreneurship under the background of New Engineering. Journal of Higher Education, S1, 37-39.