Research on the cultivation mode of innovative talents in mechanical and electronic engineering based on OBE concept

Lipeng He[a]*, Chensheng Wang[a], Yuhang Han[a], Lei Sun[a], Hongxin Wang[a], Xu Gao[b]

[a] Key Laboratory of Micro/Nano and Ultra-Precision Manufacturing (Jilin Province), School of Mechatronic Engineering, Changchun University of Technology, Changchun, Jilin 130012, China.

[b] School of Electro-Optical Engineering, Changchun University of Science and Technology, Changchun, Jilin 130012, China.

*corresponding author. E-mail address: lipeng_he@126.com

Abstract. Take engineering certification as an opportunity, benchmark the engineering certification standards and find out the problems and shortcomings of the major. With the goal of talent training and graduation requirements combined with repositioning, the curriculum system setting and the reform of practical aspects of engineering education, the talent training program model of mechanical and electronic engineering majors is carried out to establish a new model of "student-centered", "goal-oriented" and "continuous improvement" result-oriented talent training.

Keywords: OBE**;** The talent training program model**;** Mechanical and electronic engineering

1 Introduction

The implementation of professional certification of engineering education is a key task of the Ministry of Education during the 13th Five-Year Plan period, which is not only helpful to promote the professional development of higher education institutions, but also to improve the quality of talent training [1]. The core concepts of engineering education professional accreditation standards mainly include three aspects: student-centered education concept, goal-oriented education system and quality view of continuous improvement, which guide teachers' daily teaching activities with the achievement of students' training goals and graduation requirements, and students' performance is the focus of the success or failure of engineering education [2]. China's current engineering education talent training system is established in the process of traditional industrialization, the scale of engineering education is huge and the number of engineering students is large, and mechanical and electronic engineering is a traditional engineering specialty, so in the background of professional certification of engineering education, the traditional talent training mode of mechanical and electronic engineering does not

S. Yacob et al. (eds.), *Proceedings of the 2023 7th International Seminar on Education, Management and Social Sciences (ISEMSS 2023)*, Advances in Social Science, Education and Humanities Research 779,
https://doi.org/10.2991/978-2-38476-126-5_116

fully meet the requirements of training innovative talents. Therefore, in the context of OBE, it is also very urgent to study the innovative talent training mode of mechanical and electronic engineering that can meet the requirements of professional accreditation standards, reflect international substantial equivalence, and have distinctive characteristics.

2 Problems of traditional engineering talent training model

In China, in the education of higher education institutions, the traditional mechanical and electronic engineering majors take the training of applied technical students as the main goal, and the practical teaching sessions are mostly based on theoretical teaching, with hands-on skills and technical applications as the supplementary practical teaching system, which is difficult to adapt to the needs of innovative and applied talents training required by enterprises [3].

2.1 Unclear positioning of course objectives

Compared with the 0BE education concept under the requirement of "New Engineering", the curriculum system and course objectives in the traditional engineering teaching concept are plan-oriented and emphasize faithful execution. At present, driven by the integration of industrial structure, many engineering colleges and universities realize that the focus of university education is on "education" rather than "teaching"[4], and the curriculum settings are gradually diversified, but the curriculum system is still the same and lacks core courses. However, the curriculum is still homogeneous and lacks core courses, which cannot fundamentally solve the problem of "emphasizing theory rather than practice", and the curriculum structure still focuses on basic theoretical knowledge, which makes it difficult to connect courses. In addition, the class size is large, the teaching method is teacher-centered, the teaching is divided into different subjects, students compete with each other, and the learning style of students is mainly receptive learning and mechanical memorization, and students can only passively accept the requirements of teachers. But there are many problems, and it is difficult to teach all students in a centralized way, which is not conducive to the personalized development of students as emphasized in the background of "New Engineering".

2.2 Lack of innovative practical links

In traditional engineering education, there is a lack of innovative practical teaching links, and innovation education cannot be fully integrated into the teaching of professional courses. At present, many institutions of higher education do not pay enough attention to the role of practice, and there are fewer practical training bases and so on, which cannot really cultivate students' practical ability and creative ability, and the innovative consciousness cannot be better explored in practice, but can only stay in books. Therefore, students' graduation design also lacks practical experience and experience, which makes the gap between students' graduation design and real problems

exist to a certain extent. Teachers are also to blame for the lack of students' awareness of innovation ability. In addition to teaching students professional basic knowledge, professional teachers should understand the importance of innovation ability in today's society according to the current development of the industry, and some teachers lack the ability of engineering practice and "duck-fill" teaching. Teachers do not know the actual situation of production deeply enough, which leads to the lack of practical teaching links, and naturally students are not enthusiastic enough to meet the needs of innovative talents training.

2.3 Single evaluation method

The traditional education concept talent training process is evaluated in a single way, with knowledge-oriented, paper-and-pencil tests as the result and summative evaluation. Teachers focus on the evaluation results rather than the learning process of students, and define students' ability by the results, which limits students' opportunities for success. Besides, students may lack self-efficacy in the learning process, and reduce their interest in learning, and the lectures are mostly theory-based, which is inevitably boring and tedious. As a result, students are not strong in both theoretical knowledge and practical ability when they enter the enterprise. In addition, the evaluation system of some engineering colleges and universities lacks continuous improvement links and the positioning of talent training objectives is not clear, which leads to the inability to reasonably evaluate the achievement of students' learning outcomes in all aspects and makes it difficult to cultivate innovative and applied talents.

3 Innovative talent training model incorporating OBE concept

With the basic principle of training innovative talents and meeting graduation requirements; from the construction of curriculum system, innovative teaching platform, faculty team, and continuous improvement of evaluation, the system of training innovative talents is oriented to achieve the target results, and teachers' teaching, students' learning, scientific research and competition are closely linked and mutually promoted. The details are shown in Fig 1 below:

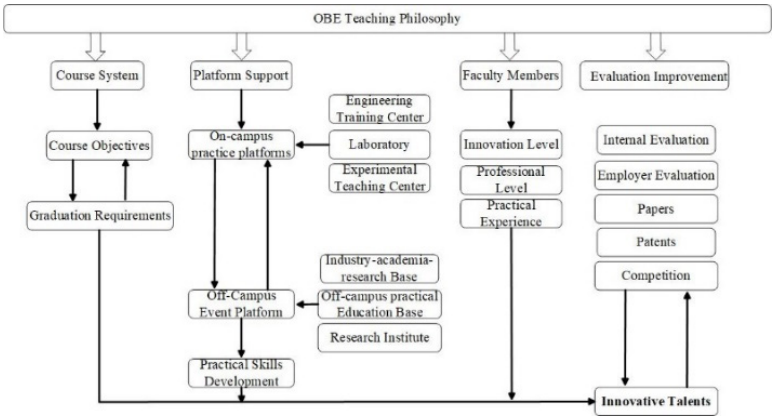

Fig. 1. OBE teaching concept of mechanical and electronic engineering professional talent training system.

3.1 Classroom reform

Based on the problems existing in traditional engineering disciplines on the classroom teaching reform was carried out, with an emphasis on open teaching in a result-oriented manner. With the reverse design in the direction of objectives, the course teaching objectives are constructed based on the external evaluation of multiple factors such as employers, enterprise professions, experts in the industry and employment of previous graduates, combined with the internal evaluation of multiple factors such as teachers in charge of the class, professional leaders, school and college supervisors and recent graduates, under the satisfaction of students' graduation requirements (Fig 2). Integrate the existing teaching resources in school, embed the case teaching, project teaching, discipline competition content and technology innovation seminar based on practical application into the teaching of basic courses and professional core courses of mechanical and electronic engineering, and provide targeted teaching to achieve the personalized development of students emphasized under the new engineering discipline.

The training of talents should be built on the teaching of professional courses, the curriculum of engineering majors, combined with the education of core courses, reasonable professional settings as well as curriculum arrangements. While emphasizing theoretical knowledge training, we should pay more attention to the development direction as well as the development characteristics of the major, according to the current situation of industry development, combined with the development of the local industrial economy, to achieve harmony and unity with the industry, and cultivate students' innovation and practical ability.

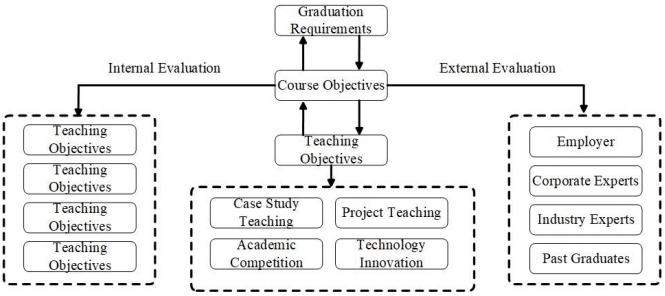

Fig. 2. Course system development process

3.2 Practice innovation platform construction

Increase open experiments, establish corresponding centers for students' innovative experimental activities, assign relevant professional instructors, and strengthen financial security. Improve the innovation education system and increase the practical aspects of the curriculum. It is integrated by the internal teaching experiment center, engineering training center and university-enterprise cooperation internship base, mainly for students of different grades, and gradually carry out the progressive practical training of "engineering cognition - skills training - comprehensive practice engineering innovation" in stages and levels, focusing on cultivating students' engineering awareness, engineering practice and innovation ability [5].

Academic research and innovation is the soul of innovation and entrepreneurship education, which can promote students' awareness of technological innovation and cultivation of engineering application ability by intervening in teachers' research projects, and improve teachers' "double teacher" quality and ability, so as to meet the learning needs of innovative and entrepreneurial talents.

Internship work of university students is an important part of the teaching program of higher education institutions, and it is a key link for students to combine theory and practice and develop their comprehensive ability [6]. In order to avoid the formal development of the internship base, the connotation construction of internship base inside and outside the school of applied colleges and universities is first of all a precise starting point, and the cultivated applied innovative talents should have solid professional theories, strong innovation consciousness and professional and technical abilities, and can immediately adapt to the work positions of enterprises and solve the current problems of enterprises in engineering technology, etc. A series of abilities and technologies. Secondly, according to its own actual situation, on the basis of adhering to the principle of win-win development between the school and the government, enterprises and society, to achieve a multi-win situation.

Vigorously integrate social resources, cooperate with enterprises to set up substitute training classes, explore a new mode of training innovative and entrepreneurial talents with professional characteristics, and establish a deep-level cooperative education system between schools and enterprises by jointly formulating talent training programs, jointly implementing the training process, jointly building "dual-teacher" teachers,

jointly developing scientific research projects, and jointly promoting students' employment and entrepreneurship. The system is to establish an in-depth collaborative education system between schools and enterprises. Through the "embedded" teaching mode, the content of enterprise culture, professional technology, market demand and enterprise management is embedded into the teaching process, which transforms from a single professional knowledge learning to a multifaceted development of learning knowledge, practical application, understanding the industry and expanding horizons, which can help students clearly understand innovation and entrepreneurship, find entrepreneurial opportunities and identify entrepreneurial risks, and effectively improve students' understanding of innovation and entrepreneurship, It can help students clearly understand innovation and entrepreneurship, find entrepreneurial opportunities, identify entrepreneurial risks, effectively enhance students' innovation consciousness and entrepreneurial ability, and pave the way for students to understand market demand information for entrepreneurship. (As shown in Fig 3)

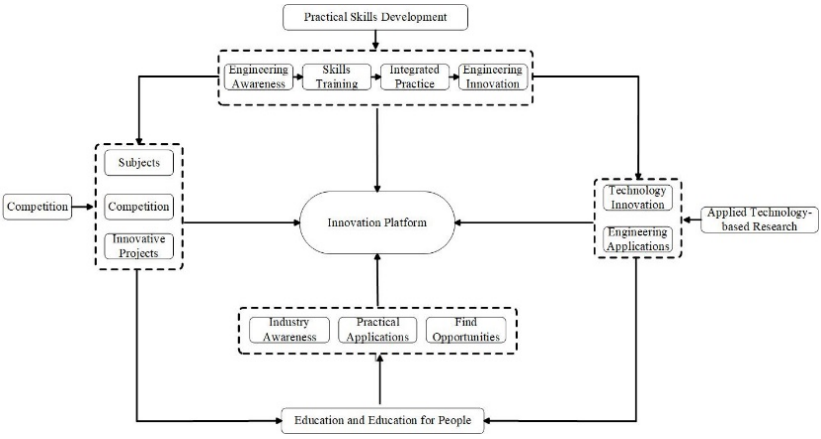

Fig. 3. Innovative education platform.

3.3 Faculty development

We train innovative teachers comprehensively in terms of practical experience, professional level and innovation level, regularly go into the practice of enterprises to help understand the R&D status of enterprises, follow the frontier issues with students as the center in order to find scientific research topics that are helpful to students, grasp the status of market demand for talents, condense the direction of scientific research, and understand the focus and direction of talent training.

The teacher is a key factor in the realization of the OBE teaching philosophy. To be a good teacher should be proficient in both the theoretical knowledge of the profession and professional operational skills, when students encounter difficulties in their research, use heuristic and innovative teaching techniques, and actively turn to other teaching concepts, leaving more opportunities for students to operate their own practice in order to solve realistic practical problems, establish spiritual and emotional

connections with students while also developing their inquisitive and creative abilities, and also Understand student creativity and ideas. Using encouraging praise to teach students according to their abilities, giving them the opportunity to learn to exercise and experience, stimulating their creative potential, and combining classroom knowledge teaching and innovative practical teaching into an integrated teaching model will make the probability of converting students' innovative theoretical results and scientific research to business models much higher.

3.4 Talent development evaluation

The evaluation of talent training under the OBE concept is competence-oriented, combined with classroom teaching reform, practical innovation platform construction and teacher integration after the background of engineering education certification, mechanical talent training system in our school after the application of mechanical engineering professional practice, through the investigation and analysis of teachers, parents, employers and students in thesis, patents, competitions and other aspects of the results achieved, qualitative evaluation is the main, quantitative evaluation The evaluation is diversified, focusing on students' learning process and their ability to solve practical problems, and according to the feedback information, continuous improvement is carried out to improve the weak links in the construction system, so as to better meet the requirements of the market and society for the professional talents through the problems found in the process of improving the training of talents, and to promote the improvement of the quality of the training of talents in mechanical engineering.

4 Conclusion

Since the concept of "New Engineering" was put forward, our mechanical and electronic majors have combined the OBE education concept to realize the combination of theory and practical innovation ability, following the logic of education and refining the direction of talent training, providing practical ideas for colleges and universities to cultivate high-quality talents in terms of training quality and training methods. Through the school level of talent training methods planning to the student level to implement the plan, so that students in the thinking of innovation effect is remarkable. Transforming the concept of employment, promoting the transformation of scientific and technological achievements into actual production, contributing to the promotion of electromechanical industries, and providing enterprises with engineering application talents that meet the development needs of the industry.

Acknowledgement

This work was supported by the Jilin Province Higher Education Association Project (JGJX2021C25), the Jilin Province Higher Education Association Project

(JGJX2021D79), Special Supervisory Research Project of Jilin Provincial Education Science "The Fourteenth Five -Year Plan" in 2021(ZD21030).

References

1. Wang Y. Exploration of Talent Cultivation Mode in the Context of Engineering Education Accreditation and New Engineering - An Analysis Based on the Electronic Information Engineering Major of Guilin Institute of Aerospace Industry. Survey of Education. 2018;7:73-5.[in Chinese]
2. Zhou T, Liang P, Yi Y. A Preliminary Study on the Accreditation System of Engineering Education Programs in Local Undergraduate Institutions. Asia-Pacific Education. 2015:31. [in Chinese]
3. Wu L, Wang Y, Yang L. Problems and optimization path of practical teaching in economics and management of independent colleges. Heilongjiang Education(Higher Educational Research and Evaluation). 2019:55-7. [in Chinese]
4. Wang X. Research on talent cultivation model of local engineering colleges based on OBE: harbin university of science and technology; 2019. [in Chinese]
5. Li W, Song Y. Reform and practice of engineering awareness courses based on the background of engineering education accreditation. Heilongjiang Science. 2018;9:70-1. [in Chinese]
6. Wang W. Exploring the Innovative Model of "Internet+" Internship Workshop in High Schools. Jounnal of Higher Education. 2019:29-31. [in Chinese]