

Exploring the cultivation of innovative talents in mechanical disciplines in the context of the new engineering discipline

Jiading Bao^{a,1}, Rongjiang Tang^{a,2,*}, Shuilong He^{a,3}

^aSchool of Mechanical and Electrical Engineering, Guilin University of Electronic Technology, Guilin, Guangxi, 541004

Abstract. With the improvement of China's economic and technological development level, the concept of "new engineering" has been paid more and more attention. As the main force to promote the development of China's manufacturing industry, the cultivation of innovative talents of mechanical majors will play a very key role. Based on this, this paper analyzes the current situation of the cultivation of innovative talents in mechanical major. We put forward some effective training strategies, such as the construction of a new talent training model and the establishment of an integrated teaching system.

1. Introduction

With the rapid development of the economy, China has become the world's largest industrial manufacturing country and product trading country. The new economy, characterized by new technologies, services, industries, and models, is booming and urgently needs a large number of new engineering and technology talents [1]. As an important base for talent cultivation, higher education institutions urgently need to deepen the reform of higher engineering education, fulfill the responsibilities of higher engineering education in talent cultivation, and take up the sacred mission of cultivating socialist builders and successors with all-round development of morality, intellect, physical fitness and aesthetics to achieve the great rejuvenation of the Chinese nation [2]. In February 2017, the Department of Higher Education of the Ministry of Education issued the Notice on Research and Practice of New Engineering (Letter [2017] No. 6 of the Department of Higher Education of the Ministry of Education), which deployed the research contents and organizational arrangements, and then formed the "Fudan Consensus"[3], "Tianda Action"[4] and "Beijing Guide"[5], which constituted a "trilogy" for the construction of new engineering disciplines, played the main melody of talent cultivation, opened up a new path of engineering education reform, and comprehensively launched the construction and development of "new engineering disciplines" [6-7]. As a typical traditional engineering major, the development of mechanical engineering has become one of the important factors to promote social and economic development. In the face of rapidly developing and changing technology and industry needs, the training of mechanical talents requires reform and innovation, optimization of teaching contents, exploration of new teaching modes and teaching methods, and transformation of talent training to application-oriented and innovative talents. In recent years, the Ministry of Education has invested more resources in the construction of

new engineering disciplines, which in turn has effectively enabled the exploration of advanced talent training models and experiences. Under the influence of the new engineering concept, the practical and innovative training of mechanical students should be further strengthened to promote their comprehensive quality.

2. Current Situation of Training Innovative Talents in Machinery

The traditional way of training mechanical talents in colleges and universities is based on closed education in schools, with less communication with enterprises; the teaching of textbook knowledge is the main focus, with less engineering practice; the emphasis on this professional knowledge coverage, ignoring interdisciplinary cross-fertilization [8]. The hands-on practical ability and innovation ability of students cultivated under the traditional mode is poor and cannot meet the needs of new industrial development. Combined with the training of innovative talents in machinery, its main problems exist in the following aspects.

2.1. Inadequate Curriculum

At the present stage of the study, a large part of the student's time is spent on learning open basic courses and professional basic courses, and the learning time of these professional courses is tight, learning content, resulting in students in the learning process, often can not digest the knowledge learned in the classroom on time, and there is no time for professional skills training. The existing curriculum of the mechanical profession is still based on the traditional curriculum, although the integration of some new courses demanded by the changes in society and enterprises, but the curriculum system has a certain gap with the needs of the industry. In particular, the problem of poor

¹jdbao@guet.edu.cn, ²251444972@qq.com, ³247613186@qq.com

*Corresponding author's e-mail: 251444972@qq.com

connection between theory and practice, and poor connection between in-class and out-of-class is prominent, resulting in students' knowledge system is not solid, and the formation of their engineering practice ability and innovation ability does not play its due role [9]. Therefore, the construction of the curriculum is the most urgent task to cultivate high-quality applied talents.

2.2. Poorly Updated Teaching Content

To strengthen the training of innovative talents in the mechanical profession, the school must update the teaching content, which is the only way to ensure that the students learn advanced knowledge and practicality. However, at present, most universities in China still take theoretical teaching as the main way to teach students, but when teaching mechanical students, if only through theoretical teaching, not only can not deepen students' mastery and understanding of knowledge, but also reduce students' interest in learning and lack of enthusiasm in the learning process, so this teaching method is difficult to adapt to the student's professional knowledge and professionalism. It is difficult to meet the needs of students for professional knowledge and skills. This teaching method not only deepens the difficulty for students to grasp knowledge but also is not conducive to the cultivation of students' practical operation abilities.

2.3. Practical Teaching Sessions Need to be Enhanced

To cultivate mechanical professionals, practical teaching is an essential part of the teaching process. At the present stage, when major universities carry out practical teaching, it is mainly realized through experimental courses and course design within the school as well as an off-campus internship. The practical teaching method of in-class experiments not only lacks sufficient innovation in experimental content but also has few experimental links in teaching tasks, which cannot well meet the objectives of practical teaching and enable students to better master professional knowledge and skills. Moreover, the experimental contents of many universities have been detached from the development of new technologies and cannot supplement the teaching contents. In addition, the practice of off-campus internship is mainly in the form of walking around, not allowing students to participate in practice, resulting in a lack of sufficient interest in practical skills, making it difficult for students to link practice with theoretical knowledge. Not only this, but the short duration of practice makes the internship ineffective and does not achieve the desired effect.

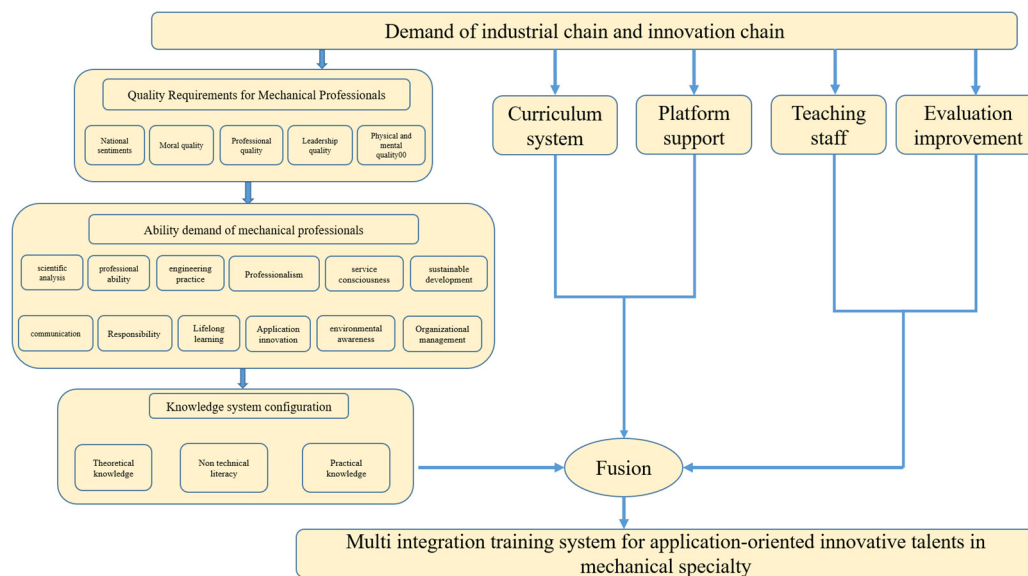


Fig. 1. Diversified integration cultivation system for innovative talents in mechanical disciplines [8]

2.4. Single Faculty Structure

At the present stage, the way to expand the scale of teachers in major universities in China is mainly to introduce and cultivate and continuously improve the academic qualifications of these teachers, most of whom have worked from school to school, lacking working experience in the enterprise industry and lacking engineering practice ability. Although these teachers have solid theoretical knowledge, they do not have the corresponding engineering practice ability, so these teachers tend to attach importance to theoretical teaching in the teaching process but

neglect practical teaching, making students' practical skills weak. In addition, there are few teachers with industry backgrounds and practical experience in universities, and the composition of the teachers is homogeneous, resulting in a serious shortage of teachers for experimental and practical courses. Many teachers cannot carry out practical teaching and have the ability to innovate, thus failing to meet the needs of the training of mechanical professionals.

3. Effective Measures to Strengthen the Cultivation of Innovative Talents in Mechanical Disciplines Under the Background of New Engineering Disciplines

3.1. Building a New Talent Training Model

In the context of the new engineering discipline, the training of mechanical professionals is facing innovation and change. In addition to paying attention to the improvement of cultural and moral qualities, it should further adapt to the current stage of economic construction needs, pay attention to the cultivation of their practical and innovative abilities, and thus encourage mechanical professionals to actively engage in intelligent manufacturing, scientific and technological development, applied research and other fields. In determining the specifications of talent training, higher education institutions also need to adapt to the needs of regional economic development, to implement the diversified training modes of innovative talents, practical talents, and technical talents in a targeted manner. On this basis, universities should effectively construct their innovative talent training programs oriented by market demand, to adapt professional and technical training to students' personality development on the one hand, and ensure the organic combination of the first and second classes on the other. At the same time, universities should also summarise the relevant development concepts based on the original mode of training mechanical professionals, gradually deepen the combination of teaching, scientific research, and practice, and maximize the students' innovative consciousness and innovative ability.

3.2. Establishing an Integrated Training System

The construction of an integrated teaching system is also an important prerequisite for improving the level of personnel training. In this process, the existing curriculum structure should be used as the basis, while incorporating appropriate innovative knowledge and advanced technology, in keeping with the concept of new engineering to the maximum extent possible, to lay the foundation for the development of professional personnel training. In the process of building an integrated teaching system, it is necessary to further clarify the knowledge and competencies that students of mechanical subjects need to master in the context of the new engineering discipline, through the joint participation of professional teachers, enterprise personnel, and industry experts. At the same time, the school should also adapt to the integrated teaching mode through curriculum reform on time, concentrating teaching, practice, and research in the basic mechanical courses, to lay a good foundation for the all-round development of students.

Through the reform and practice of curriculum system, practice platform, teacher team, and evaluation system, we can realize the integration of theory and practice, integration of in-class and out-of-class, integration of in-school

and out-of-school, integration of technical and non-technical, integration of industrial chain, innovation chain and professional chain, and build a diversified and integrated training system for innovative talents of mechanical majors, to cultivate highly qualified and applied innovative talents of mechanical majors with "solid foundation, strong ability, and high quality" [8].

3.3. Focus on Students' Creative and Intellectual Abilities

In the process of personnel training, a large extent lies in enhancing students' innovation and knowledge, helping them to think in practice, and thus achieving the purpose of expanding their comprehensive qualities and abilities. In this process, due attention should be paid to the adjustment of the structure of the professional curriculum system to ensure that the professional characteristics can be highlighted and the classification and training of students can be implemented under the influence of the new engineering model. To enhance the student's sense of innovation, the teaching should focus on the reduction of outdated course content and the introduction of modern and innovative subject content such as "industrial robotics" and "sensor technology". It is also worth noting that the individual differences and interests of students should be taken into account when cultivating talents, to actively implement a targeted and personalized talent cultivation model and ensure that students' enthusiasm and initiative in participating in practical activities are enhanced [10]. Practical teaching is an important part of engineering education and an important link in cultivating students' practical and innovative abilities. In the process of cultivating students' knowledge and ability, it is necessary to reform the practical teaching mode, focus on cultivating students' independent learning ability and practical operation skills, and further highlight the stage of talent cultivation, to gradually improve the breadth and depth of learning content and cultivate high-quality applied talents with innovative consciousness.

3.4. Strengthen the Construction of the Teaching Team and Enhance the Engineering Practice Capability of the Teaching Team

The cultivation of high-quality applied talents with innovative consciousness is inseparable from an excellent team of teachers, and under the background of the new engineering discipline, universities need to focus on the improvement of teachers' engineering literacy. Young teachers are selected to go to front-line enterprises for training and study, more targeted application-oriented training and further training are held, and teachers are encouraged to actively participate in application-oriented skill competitions and encouraged to take industry qualification examinations. Make the full-time teachers in the curriculum system both teachers and engineers, with better teaching and engineering abilities at the same time.

The introduction of enterprise engineers with rich experience in engineering practice optimizes the teacher

structure of universities and employs more enterprise engineers to participate in the teaching of professional courses and the formulation of professional talent cultivation plans, to cultivate and improve students' professional ability, engineering practice ability, professionalism, organizational and management ability, and innovation awareness and ability under the rich engineering practice experience of enterprise engineers.

3.5. Promote School-Enterprise Cooperation and the Integration of Production, Learning, and Research

The construction of off-campus internship and training bases is a guarantee of the quality of talent training and an important practical teaching link to improve students' practical hands-on ability and cultivate high-quality application-oriented talents and is the main channel for students to contact the society, understand society and serve society. Through open sharing and interaction with enterprises, many relatively stable off-campus bases integrating talent training, continuing education, technology research and development, and technical services are built together; through the joint development of an internship management system by schools and enterprises, a system of skill training, engineering ability cultivation, and vocational quality cultivation based on production sites are established, as well as a mechanism for revising information feedback on talent training objectives and training programs.

In the process of professional construction, the teachers of the professional teaching team are constantly exploring the topics of professional construction, curriculum reform, and practical teaching system, further optimizing teaching management, optimizing classroom teaching structure, and improving teachers' teaching level and classroom teaching effect through scientific research activities. The academic atmosphere of professional construction is gradually formed, which is "promoting teaching by scientific research and teaching by summarizing and teaching scientific research to drive innovation".

4. Conclusion

Under the background of the new engineering concept, it is a long way to go to cultivate mechanical students into professional talents with practical and innovative abilities. Given the existing problems in the cultivation of mechanical professionals, such as the lack of reasonable curriculum settings, untimely updating of teaching contents, and a single teacher team, teaching is required to keep abreast of the frontier technology in the professional field, constantly update and enrich teaching contents, and carry out vigorous reform and construction in the teaching mode, curriculum system, industry-university-research combination and practice platform, etc., to cultivate more high-quality talents with innovative consciousness for the mechanical industry. This is the only way to cultivate more high-quality talents with a sense of innovation for the machinery industry.

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