

## Exploration and Practice on Curriculum System Reform of Applied Innovative Talents Training in Mechanical Engineering

Xiulin Sui<sup>1a,\*</sup>, Xianli Liu<sup>2,b</sup>, Tiequn Duan<sup>3,c</sup>, Yiwen Wang<sup>4,d</sup>, and Qiufeng Wu<sup>5,e</sup>

School of Mechanical and Power Engineering Harbin University of Science and Technology  
Harbin, China

a\*xiulinsui@163.com, bxlliu@hrbust.edu.cn, ctqduan@163.com, dyiwen0451@sina.com,  
e381867890@qq.com

**Keywords:** Mechanical engineering; Applied innovative talents; Curriculum system; Training objective

**Abstract.** Talent is the decisive factor of national competitiveness, and the application ability of innovative is a core competence of scientific and technological talents in the new period. This article regards applied innovative talents of mechanical design, manufacture and automation as the study object, and expounds the exploration and practice of curriculum system and teaching content reform on applied innovative talents training in mechanical engineering, from the respects of the training target of applied innovative talents training of mechanical engineering, the principle of formulating curriculum system and the establishment of curriculum system.

### Introduction

With the rapid development of China's modernization drive, the scale of higher education has continued to expand, and the reform of higher education system has been deepening, the teaching work in colleges and universities is faced with many new situations and problems, and the task is more arduous. According to the urgent demand of applied innovative talents, the applied innovative ability in undergraduate teaching is becoming more and more important. Therefore, we must adhere to the scientific development concept, and realize the shift of the focus of higher education. At the moment of continue growing the scale, reform of innovation personnel training mode and system to face the practice demands of enterprise, it is our duty to build an innovative country and a strong province of higher education, set up the concept of higher engineering education "facing the industry, facing the world and facing the future", establish the concept of active service national strategy and active service industry enterprise demand, school enterprise cooperation, integration the industry university research. Train a large number of shortage talents in the adjustment and reconstruction of equipment manufacturing industry, enhancing the core competitiveness of Heilongjiang province, lay a solid human resource advantages to revitalize northeast old industrial base, provide engineering and technical personnel reserve to Industrialization and modernization of the state.

This paper explores the curriculum system of applied innovative talents training in mechanical engineering to reform and explore the training mode and teaching content system of applied innovative talents, the training target and the principle of curriculum system of mechanical engineering application innovative talents to be put forward. In the mechanical engineering application innovation talents training curriculum system optimization, practice teaching system reform, teaching methods and means of innovation and many other aspects of research, efforts should be made to improve students' engineering consciousness, engineering quality and engineering practice ability, active service our province's development strategy, active service social demand. To explore a suitable training mode and approach for mechanical engineering innovation talents in common local colleges and universities, training qualified personnel in the adjustment and reconstruction of equipment manufacturing industry, it has important practical significance for satisfying the development of the mechanical industry and serving the local economy in our country.

## **Training Target of Mechanical Engineering Applied Innovative Talents**

Pay attention to training and shaping students' sound personality and social responsibility, good humanistic and social science literacy, critical thinking and innovative spirit, strong basic theory in the fields of natural science, dynamics, mechanics, engineering materials, electrical and electronics, and computer applications, broad knowledge of mechanical engineering and good engineering practice ability, to meet the needs of science and technology, industrial progress and social development, be able to engage in technical development, engineering design, manufacturing operations, scientific research and marketing management in the field of mechanical design, manufacture and automation.

The students have extensive basic theoretical knowledge, Basic knowledge of discipline and good professional knowledge in mechanical design manufacture and automation. The main characteristic is not only the integration of theory and practice, but also the coordination of knowledge and ability and the balance between technology and non Technology, Embodied in the quality and ability, knowledge and skills, technology and innovation, traditional and modern, design and manufacturing, mechanical and electrical and computer applications, such as the combination of professional characteristics. In particular, make a more systematic and comprehensive study in cutting theory and cutting tools of expertise. Enable students to have strong professional characteristics and competitiveness.

## **Principles of Formulating Curriculum System**

1. Achieve the goal of knowledge, ability and quality coordinated development. In the course system, strengthen engineering knowledge, including public basic knowledge, technical basic knowledge and professional knowledge. And create a workplace atmosphere and environment, combining experiment teaching in class and engineering practice in outside class, especially to set up professional courses, centered on product, process or system, to conceive, design, implement and run. Redesigning the course system, and rethinking the course connect, and rearranging the teaching process. At the same time, reduce the hours in class, increase the content of practice, and increase the time of extracurricular learning and practice.

2. Reform teaching mode and update the content of teaching. To strengthen the construction of engineering education platform, practice base and teaching staff. Inherit and carry forward the engineering education mode with the characteristics of Harbin University of Science and Technology. Establish the effective engineering education operation system, quality evaluation and supervision mechanism. And actively adapt to the needs of the national and regional economic construction. To train excellent mechanical engineers who are suited to China's socialist modernization drive and have an international perspective and innovative ability.

3. Change the process and method of imparting knowledge. In terms of teaching content and methods, Change from imparting declarative knowledge to acquire process knowledge. Mainly include thinking process, comprehension and communication process, exploration process, experiment process, design process, manufacturing process, test and inspection process, etc.. This kind of knowledge can hardly be obtained from the classroom or in the book. Only through scientific and systematic practice can we master it, and some knowledge can only be recognized in practice in factories or enterprises.

4. Strengthening the training of engineering practice ability. Reasonable arrangement of practical teaching links, whether curricular and extracurricular, on campus and off campus. Establish a multi-level and high standard stable external practice base, and constructing an integrated training practice teaching system of "one in one, step by step". To create a competitive, independent learning, practice environment in the training process. So that students through "learning by doing" to better grasp the theoretical knowledge, and enhance the practical ability of practical knowledge.

5. Strengthening comprehensive quality education. In course offered and cultivation process, special attention should be paid to the cultivation of students' comprehensive quality ability. And establish a correct outlook on life and values, establish correct social basic morality. Focus on

thinking and behavior, interpersonal communication, teamwork and other aspects of training. Develop students' basic personal skills, interpersonal skills, and the ability to construct about products, processes and systems.

### **Construction of Training System**

In order to enable our graduates of the major is manufacture and automation to meet the professional requirements of knowledge, ability and quality. We take part in activities, such as communicating with employers and discussing with graduates. Grasp the market demand information for mechanical engineering technicians. And master mechanical engineer's requirement of technical knowledge, work ability and professional quality. Invite experts from the enterprises to formulate plans for the training of professionals in mechanical design, manufacture and automation, and scientific formulation of training programs and curriculum system.

**Establishment and Integration of Specialized Courses.** Revise the training plan of mechanical design, manufacture and automation to refer to the development plan of manufacturing put forward in "made in China 2025". Give full consideration to the characteristics of this major and the career direction for future graduates. At the same time, combining the training objectives and requirements of "excellent plan" and "professional certification", the curriculum in the original 2012 edition training program has been substantially adjusted and integrated. The total credits and total hours are adjusted from 198 credits and 2498 class hours to 176 credits and 2334 class hours.

The teaching contents of each course have been effectively integrated. The class hours of each course have been greatly adjusted. The number of the basic courses, specialized courses, elective courses and practical courses finished larger reduction is up to 25. According to the new version of the professional training program, new curriculum seeks to not only ensure the basics of learning but also to closely combining modern engineering technology and business needs, focus on improving students' innovative ability, professionalism and practical ability. In terms of general education courses, the program increase a lot of chemical, project management, languages and speech topics, General Secretary of the University and other courses. The course of engineering thermodynamics and heat transfer engineering course improved the "thermal" knowledge structure and strengthen the theoretical mechanics and material mechanics course. Mechanical innovation practice courses have been added to the specialized platform courses. Each student is required to take enough credits on elective courses which are divided into: computer application Foundation classes, engineering mechanics, professional quality and innovation and entrepreneurship classes, machine elective class and module categories.

**Professional Orientation and Professional Characteristics.** Major emphasis orientates the direction of the future development of the manufacturing industry trends as well as the development of emerging industries, and in particular taking into account the characteristics of research and expertise. According to the training needs of the students, professional features into 4 major modules. Module A is a modern design techniques, students focus on modern design theory and method of related specialized knowledge; Module B for students who learn advanced manufacturing technology and machinery products and parts theory; Module C is what our university good at in the long-term, students focus on learning advanced processing technology and tool design-related professional knowledge; Module D is electrical control and automation, students emphasis on mechanics and automation-related in mechanical product design. The professional orientation course is set in basic courses and specialized courses on the basis of technical knowledge and expanding.

**Reform of Practice, Highlighting the Ability of Engineering Practice Training.** Compressing or deleting the non-practical curriculum, adding design training sessions, such as yearly major design and integrated practice (independent learning) to improve students design and practical ability; opening innovative experiment to improve students' practical ability and creativity; Establishing innovation practice and social links to improve the students' ability of innovation and engineering practice.

**Strengthen Extracurricular Environmental Construction to Improving Comprehensive Quality and Practice Ability.** Given credits on enterprise research and internships, extracurricular scientific and technological activities extracurricular sectors, and various competitions. Capital and facilities support that enable students to actively participate in scientific and technological innovation, self-made experiment equipment and other activities; Encourage students to use the vacation time after school to participate in research and internships, and further increased to adapt to the environment of business engineering and understanding.

**Construction of Integrated Training Practice Step by Step.** To establishment of practice teaching system of integrated training by "social practice, cognition practice, engineering training, electrical and electronic practice, curriculum design, production practice, school design and comprehensive practice teaching system, comprehensive training practice of graduation design". Each practice link is closely integrated. By participating in a series of practical teaching links, students can master the preliminary engineering application skills, and comprehensively enhance their ability of innovation and entrepreneurship, and engineering practice ability.

**Reforming Teaching Methods and Means.** In the reform of teaching methods and examination methods, the reform of the teaching methods and the reform of the examination are carried out in the form of heuristic, interactive, exploratory, case-based, O2O, flip-class, and so on. The implementation of teaching methods is based on class undergraduate study, Internet teaching, flip class and project-based learning. Strengthen the training of students' comprehensive research quality and innovative ability, so that students' awareness of innovation and team ability can be improved continuously in the process of learning and growth. At the same time, to change the traditional assessment methods of an exam score set ", the introduction of process assessment, practical operation assessment, curriculum papers, major operations, learning performance and so on to focus on independent access to knowledge and ability to develop multi-link, cumulative performance assessment methods. Through the implementation of the examination method reform, it emphasizes the assessment and evaluation of the students' practical ability, and guides the students to consciously enhance their learning ability and exploration spirit.

## Summary

Although the application of innovative talents in the practice of China has made a lot of experience, but there are still the following questions: the unknown higher school self positioning, mode instability, lack of reform and continuous power; especially for the application of mechanical engineering innovative talents of the curriculum system is not mature, still in the exploratory stage, subject to many conditions, including internal conditions and external conditions, whether it is concepts, ideas, or system and mechanism, to explore and study. In order to train qualified personnel in the adjustment and reconstruction of equipment manufacturing industry, the cultivation of the domestic engineering college students will have to face the equipment manufacturing industry of engineering practice, guided by the employment market, cultivation of applied talents of production, research and research as a leader, to strengthen the reasonable adjustment of discipline structure, to pay attention to the training of ability, to make graduates "marketable" is the trend of development of higher education of modern China.

## Acknowledgements

This research was financially supported by the Heilongjiang Province Education Science Research Base Special Project (GJE1214009), (GJE1214010) and Heilongjiang Province Teaching reform project of higher education (Research and Practice of Training and Evaluation of Mechanical Professional Innovative Talents suitable for Engineering Education Accreditation).

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