Research on Construction and Innovation of Mechanical Engineering Professional Basic Courses Group Based on Training of Creative Ability and Practical Ability

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ABSTRACT

According to the strategy of innovation driving and manufacturing powering the country, higher mechanical engineering education need to train qualified personnel with creative ability and practical ability. Professional basic courses are offered at the beginning stage of undergraduate study. They play an indispensable role on activating students’ innovation consciousness and problem-solving skills. This paper focuses on the optimization of course objective and contents and new teaching model with competition—teaching corporation. The research and explore of professional basic course group construction and innovation have guiding significance for element education to train qualified personnel with creative ability and practical ability.

KEYWORDS
Professional basic course group, course construction and innovation, creative ability, practical ability.

INTRODUCTION

Scientific and technological innovation is strategic support that improves the social productive forces and comprehensive national strength, which occupies core position in the overall situation of national development, China is vigorously implementing the strategy of developing the country through science and education and the strategy strengthening the country through talents, and accelerates the construction of national innovation system. To serve the national innovation drive, make power development strategy, professional personnel training of China's higher engineering education mechanical and electrical is required, the innovation and practice ability training system of keeping pace with the times must be built, and cultivate the outstanding talents that adapt to industry needs, and have innovation and practice ability.

The professional basic course is a kind of course which lays the necessary foundation for professional course learning, it is set up by higher school in the course system of personnel training, and it plays a connecting role and lays a solid foundation for students to master professional knowledge skills and develop professional skills. The foundation courses of mechanical specialty as important part of training system of undergraduates' innovation and practice ability, the basic course group, explore the
method to cultivate students' innovation and practice ability, carry out the course construction and reform, and it has the significant meaning.

THE IMPORTANT ROLE OF PROFESSIONAL BASIC COURSES IN THE TRAINING SYSTEM OF INNOVATION AND PRACTICE ABILITY

The basic courses of mechanical specialty include engineering drawing, mechanical principles, mechanical designs, measurement and interchangeability and metal technology five courses. As a basic lesson, these courses emphasize basic theory, concepts, highlight basic methods and basic skills. As a prerequisite compulsory course for professional courses, the professional foundation courses lead students to enter the knowledge palace of professional field for the first time, and has an important role in developing students' interest in learning the professional knowledge and laying the theoretical and technical basis for the subsequent professional courses. These courses are mostly opened in the first, second and third semesters in undergraduate study and it is the enlightenment stage of undergraduate study. At this stage, professional basic courses can use their own professional advantages to integrate the training innovation and practical ability, and it has an irreplaceable role in activating students' innovation sense and ability to solve problems compared with other courses.

THE EXISTING SHORTCOMINGS OF TRAINING OF INNOVATION AND PRACTICE ABILITY IN PROFESSIONAL BASIC COURSES

Unclear course objectives, lack of understanding for innovation ability and engineering practice ability

There is a long history for basic courses of traditional mechanical specialty, teaching content, teaching methods and selected teaching materials after many years of Inheritance; the fixed model is basically formed. Part of the teaching contents even be are out of line with the development of mechanical engineering the field. Teaching objectives still remain in the grasp of the basic theory and methods, the understanding of training of innovation ability and engineering practice ability is insufficient, and fails to adapt to personnel training requirements under the new environment.

Old training concept of practical ability, not high training effectiveness

At present, the basic courses of mechanical specialty do not lack practical training links, such as course design of mechanical principles, course design of mechanical design, metalworking training and so on. But purpose of practice, object, method, content and other key elements of practice mostly follow the previous fixed mode in the practice training links, students passively practice, enthusiasm is not high, and causes practical ability of cultivation effectiveness is not high.

Training mechanism of practical innovation ability lack scientific and effectiveness

There are some problems the outdated teaching mode and the single training mode in the basic courses of mechanical specialty. Course goal setting, credit setting,
evaluation mechanism, incentive and guarantee mechanism lack effective innovation, students’ innovation and practice ability lack effective platform support.

COURSE CONSTRUCTION AND REFORM OF PROFESSIONAL BASIC COURSE

Target

"Outline of the National Medium and Long-term Plan for Education Reform and Development (2010-2020)" clearly aims at building an innovative country in China. The personnel training of mechanical specialty should also aim at cultivating innovation and practical ability. How professional basic courses achieve enlightenment education of high-quality innovative talents in the teaching process, the following should be noticed:

(1) Enable students to master the solid basic skills, the basic theory knowledge and skills of this specialty.

(2) Develop students’ ability to raise new problems and solve existing problems.

(3) Through the actual problem-solving to train students’ innovation senses and train practical ability.

Content Settings of Courses

The content settings of the professional basic courses should meet the requirements of innovation and practical talents training, and revise and integrate the teaching content and practice links of the existing professional basic courses.

First of all, avoid the repeated teachings of the same or similar content in different courses in the teaching content. Secondly, the traditional teaching contents are effectively sorted out, retain the classic theoretical knowledge of mechanical engineering specialty, eliminate the theories and methods that do not meet the current development situation of engineering science and technology, and add new knowledge and methods that meet the development trend of science and technology. For example, we can increase the number of teaching hours of "institutional innovation design" in the course of "mechanical principles"; add "the application of computer in solving the problem of mechanical principles", and the overall design of machine and the application of modern mechanical design methods are added in the course of "mechanical design". Third, the introduction of a large number of practical engineering cases, the scientific frontiers and engineering practice are brought into a professional basic classroom, through the case teaching, deepen the understanding and application of basic theory and method, and solve the disconnection problems between traditional teaching content and practical engineering. Finally, reform and teaching content of practice links in a manner suitable to the particular time, closely integrate the "national college students' mechanical innovation competition", according to topic of every competition, real-time set course design content, and through the same topic, get through the course design of different professional foundation course, finally form a complete mechanical innovation design case.
Establish a closely integrated training system inside and outside class

This paper aims at the goal of strengthening practice ability and innovation ability, constructs the course system of practice teaching of basic course and innovation activities combined with the whole course, engineering, diversification and inside and outside class, and cultivation practice training and innovation activities through basis of professional basic course training, and develop students' practice ability and innovation ability through practical training.

![Training system of mechanical professional basic course group.](image)

(1) Develop skills competition of basic courses, enhance students’ basic knowledge and skills of machinery

Relying on the basic course group, organize and develop all students’ skills competition around the basic courses, so as to improve students’ deep understanding for basic course theory knowledge and master the engineering capacity of machinery foundation, and train students’ rigorous and realistic engineering literacy.

(2) Build "competition-teaching" collaborative training model for mechanical innovation competition

National College Mechanical Innovation Competition is science and technology activities organized by the Higher Education School of Ministry of Education of Mechanical Specialty Teaching Committee for college students. The purpose of the competition is to strengthen the students’ practical ability training and engineering practice training, improve students’ mechanical innovation, design, production practice ability for the actual needs. This theoretical knowledge and skills that this competition is closely related to the basic course group of the machinery, which is a comprehensive survey for the basic theoretical knowledge of the students.

With the innovation competition process, related professional basic course design is integrated; topics and content of course design can be set flexibly in accordance with the theme of innovative competition. Straighten the class, extracurricular
teaching links, cover all students, so that the competition is no longer a small number of outstanding students’ activities, and overall improve students’ innovation ability.

(3) Build college students’ innovation base and develop the second classroom activities

Facing the students, the ability training as the goal, establish college students’ innovation base, provide guidance and practical platform for students and teachers who participate in the innovation and practice activities, develop students' sense of innovation, teamwork spirit and practice ability. Innovation base takes "rely on the team, self-management, the old guide new, and ability enhancement, face the competition" management mechanism, usually carry out comprehensive skills training, and face all kinds of innovative practice activities and competition, deeply organize student to participate.

(4) Share engineering training platform

Relying on the engineering training center and the basic course links of metalworking, sharing engineering training platform, under the guidance of professional teachers, develop modeling of innovative design program, and enhance students' engineering practice ability.

ESTABLISH COMPLEMENTARY TEACHING METHODS OF "ONLINE", "OFFLINE" COURSE

For the training of students of innovation and practice ability, the basic course group of mechanical specialty should be reformed from teaching content and means. Under certain premise of class hour inside class, it is bound to make good use of the Internet’s technological advantages, establish network teaching platforms that focus on development of innovation and practice ability. Strengthen settings of actual project case, innovative design methods, previous mechanical innovation contest results and other contents in the layout of online teaching content, the offline course contents achieve an effective complement, so that better and more comprehensive ensure the training of students’ innovation and practice ability.

CONCLUSION

To train the professional talents of mechanical specialty with innovation and practice ability, the professional basic course group realizes the enlightenment education of high-quality innovative talents in the teaching process, and needs the corresponding course group construction and reform. Course objectives and content closely contact with the training objectives to optimize it, college students’ innovation bases are the established around the various competitions, develop the second classroom activities, and use new teaching model "competition-teaching” collaboration, network teaching platforms which focus on innovation ability training are established, and complement offline courses, and achieve the effective improvement of students’ innovation and practice ability in the professional basic course training stage.

REFERENCES