

Research on Application-oriented Fundamental Course Groups of Mechanical Manufacture

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Abstract—With the new round of teaching reform launched in the innovation and start-up education of high education, in face of the transformation and development, a professional course group shall be established for according to characteristics of the mechanical manufacture. The fundamental course group of mechanical manufacture, reflecting characteristics of the specialty, shall be a collection of knowledge system courses shared by similar subjects, which is required and needed for other specialties under the subject and also necessary for professional studies. For the professional fundamentals of the course system, the training of professional basic skills relative to the subject is being strengthened whether in theory teaching, practical teaching or capability training, and special methods and means are adopted in the innovative teaching, and the establishment of the course groups and implementation of the teaching process can have students trained in professional skills while receiving the basic theoretical foundation needed by the specialty.

Keywords—*application-orientated; mechanical manufacture; professional fundamentals; course group*

I. INTRODUCTION

High education has undergone a stage developing from elite education to mass education, during the period, colleges and specialties have launched a series of teaching reforms on how to train the applied talents suitable for the social and regional economic development, and it is known for everyone what the result is. In May 2015, the *Opinions of the General Office of the State Council for the Implementation of Deepening Education Reform on Innovation and Start-up in Universities and Colleges* points out that the education of innovation and start-up is the trend of modern education reform and the orientation of colleges and universities in the future, currently there is still a gap between the high education and the applied and innovative talents needed by the society, so it is necessary for colleges and universities to conduct careful researches and exploration on specialties, finding a new way for training the applied and innovative talents meeting the professional needs.

To create a professional course group is an important measure to train innovative talents, which may help teachers conduct a deep research on problems relative to the course teaching, find solutions for tough problems arising in the course teaching so as to continuously improve and renew the teaching contents, better and offer teaching methods and means. The creation of the course group will make it easy for teachers in similar teaching to gather and form a team sharing a common goal and task, which do good to integrate all kinds of resources, optimize the allocation of course resources and enhance the efficient use of teaching resources and teaching levels. Following features of mechanical manufacture, as well as teaching experience of professional teams in the past years, a basic framework can be set up for the professional course group.

II. CHARACTERISTICS OF BASIC SKILLS FOR THE FUNDAMENTAL COURSE GROUP OF MECHANICAL MANUFACTURE

For the specialty of mechanical manufacture, students are required to acquire basic theory knowledge and the most basic skills through learning and skill training, including: able to skillfully select and apply mechanical and engineering materials and master the thermal treatment ways and methods related to materials; able to own basic skills in drawing reading and drawing and parts measuring; able to create teaching modeling and mechanical analysis on mechanical parts; able to select cutters and machine tools and use of measuring devices and so on. “Table I” Characteristics and framework of Mechanical Manufacture course group.

TABLE I. CHARACTERISTICS AND FRAMEWORK OF COURSE GROUP OF MECHANICAL MANUFACTURE

Specialty	Skill Characteristics and Goal	Theoretical System	Practice System
Mechanical Manufacture	Material selection and application	Metal material and thermal treatment Hot working	Experiment, training and metal working practice Metal working practice
	Drawing reading, drawing and mapping	Drawing (computer-aided drawing)	Mapping
	Modeling and analysis	theoretical mechanics and mechanics of materials	Experiment and integrated training
	Operation of process equipment	Fundamentals of mechanical manufacture technology	Experiment, training and metal working practice

III. BASIC THEORETICAL KNOWLEDGE AND PRINCIPLE FOR CREATION OF COURSE GROUPS

The construction of course groups is not a simple course regrouping or rebuilding of knowledge system, instead, it is a redesign of syllabus and teaching plans according to the special construction. First of all, after verifying that the course group is aiming at training the applied and innovative talents, we should make a deep study on the contents of each course system and confirm the basic theoretical requirements that the specialty and degree education corresponding to the course will reach, verify what to teach, how to teach and the teaching

effect, etc. As such, the teachers are required to carefully comb the contents of course knowledge system, deleting those redundant and outdated in the course and adding some new and embodying the application. Second, for the contents between different courses are repeated, so special analysis shall be made by teachers on how to integrate the contents among them, whether it is done between professional courses or courses inside fundamental courses, the construction of course groups differ from the rebuilding of a single course or the regrouping or deletion of the knowledge system of a single course, instead, it aims to achieve the integration of several courses concerned according to the characteristics of the specialties. In order to delete those outdated and add some new, it is a must to break the framework where the course content system is over stressed for the construction of a course, and we should aim at the construction of a big course, namely integrating several courses and adjusting the inner structure of the big course system and rebuilding the contents so as to avoid the repeated between each other.

IV. CONCEPT FOR THE INTEGRATION OF FUNDAMENTAL COURSE GROUPS OF MECHANICAL MANUFACTURE

According to the characteristic requirements for the talent training of the fundamental course groups of mechanical manufacture and following the basic principle for the course groups, when creating the course groups, first of all, it needs to reconfirm the syllabus and teaching plans in line with characteristics of the course groups. Considering skill characteristics and professional features of the mechanical manufacture, we should highlight the contents as shown in "Table II".

TABLE II. CORE CONTENTS IN THE SYLLABUS OF FUNDAMENTAL COURSE GROUPS OF MECHANICAL MANUFACTURE

Course Group	Core Course	Contents of Basic Theories	Comprehensive Contents	Purpose
Mechanical Manufacture Course Group	Mechanical drawing	Projection relationships between point, line and plane, expression of parts diagram; expression of assembly drawing, computer-aid 2D drawing, computer-aid 3D drawing.	Mapping and expression of single assembly	Enable students to be good at computer-aided parts drawing and assembly drawing
	Material and heat treatment	Characteristics of metal materials, purpose and function of heat treatment, frequently used heat treatment, selection and use of spare parts	Making drawings, selecting spare parts and heat treatment under different conditions	Enable students to learn how to select spare parts and heat treatment
	Theoretical mechanics	Take the equilibrium conditions and equilibrium equations of various types of force systems to calculate the equilibrium of single object and simple object systems, grasp basic concepts and methods of motion synthesis and decomposition. Skillfully master the point speed synthesis theorem and acceleration synthesis theorem as well as its use, master the general theorem of dynamics (including the momentum theorem, the momentum moment theorem of fixed points and centroids, kinetic energy theorem) and corresponding conservation laws	Form mechanics equations for spare parts under different conditions, and calculate it.	Analyze gear stresses and form an equation
	Mechanics of materials	Service life of different parts under different stresses	Service life of spare parts under different stresses	Analysis of stresses on shafts, gears and so on
	Fundamentals of mechanical manufacture technology	Cutters, machine tools, clamps, process equipment and use of measuring devices	Typical parts processing method	All kinds of parts processing

V. PROBLEMS EXISTING IN THE FUNDAMENTAL COURSE GROUPS OF MECHANICAL MANUFACTURE

The creation of fundamental course groups of mechanical manufacture makes it well referenced for the construction of several specialties relative to the mechanical engineering, with the creation of core course systems in the course groups, the theoretical systems among the courses are correlated and strictly related logically, corresponding practices are needed for efficient communication and improve students' study efficiency, which is considered a great push to the construction of courses and faculties. However, for each course has an emphasis of its own, the time setting for the courses may differ. Accordingly it may be difficult for teachers to well connect theories and practice during the teaching. In addition, the contents of some core courses in the mechanical manufacture are overlapped, during the class teaching, generally the contents overlapped are not taken as an important part in teaching, yet the contents may form connections between core courses and key points. In the meantime, there are no deep communications between teachers, as a result, the contents will become barriers for students to study during the teaching.

VI. CONCLUSION

The creation of the fundamental course groups of mechanical manufacture can improve students' efficiency in study, bringing great help to the construction of courses and faculties, and the professional course system formed will play a significant role in the theory teaching, practical teaching as well as capability training, from which, students may not only be trained in the most basic fundamentals of theories relative to the specialty but also have their basic skills used.

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