Study and Practice on Course Reformation for Engineering Materials and Fundamentals of Mechanical Manufacture

Ying Xia Yu [a], Bo Lin He[b, *], Shu Zhen Li[c], Zhi Sen Zhang[d]

School of Mechanical & Electrical Engineering, East China Jiaotong University, Nanchang, Jiangxi, 330013, China

[a]yyxhbl@163.com, [b]hebolin@163.com, [c]13870955601@163.com, [d]254388550@qq.com

Keywords: Engineering materials; Foundation of mechanical manufacturing; Teaching content; Teaching method; Teaching reform .

Abstract. This article analyzes the current situation and existing problems of Engineering Materials and Fundamentals of Mechanical Manufacture teaching， and in order to improve the teaching effect of this course, we proposed some relative improvement measures on the aspects of teaching content, teaching means and teaching methods

Introduction

The cultivation of innovative talents is the call of the time, many universities carry out a variety of active exploration around this requirement. Engineering Materials and Fundamentals of Mechanical Manufacture is given more attention in Universities with its unique system of knowledge-intensive, generally the course and engineering training center combine to provide strong support for the practice of innovation ability of students.This course consists of Engineering Materials and Mechanical Manufacture.Engineering Materials is about the form commonly used in modern industry,the performance and application of commonly used materials and advanced materials,and the selection of common materials.Mechanical Manufacture is about cold working and hot working principle, processing process and selection of processing technology, all kinds of advanced manufacturing technology method and application.The teaching of this course is to cultivate the students to obtain the basic knowledge of engineering material and its forming method and mechanical parts processing,which lays the foundation for the further study of other relevant courses,at the same time also to provide fast industrial knowledge of different professional students, cultivating the compound type talents.

The existing problems in teaching work

Engineering Materials and Fundamentals of Mechanical Manufacture is a comprehensive professional foundation courses， the curriculum is important engineering minor professional.This course has four characteristics: first, it is formed on the basis of long-term practice, have very strong practicality; Second, the content involves from all disciplines of the material parts, has a strong comprehensive; Third, the content is derived from production and constantly updated, including new materials, new technology, new process; Fourth, the content of the systemic and rigor is poorer, lack of rationality. These characteristics has caused many problems of classroom teaching, such as the content of the narrative, more tedious.There are inharmonious phenomena in traditional teaching.The teachers and the students lie in opposite position.They act in the dissimilitude role[1].

Teaching content. A single teaching material can not teach students in accordance of their aptitude. At present, many colleges and universities in the selection of teaching material of Engineering Materials and Fundamentals of Mechanical Manufacture, the teaching outline and teaching standard is the same, whether mechanical major or related major. However, this course is different to the requirement of the students according to different specialty. Mechanical engineering students should emphasis on manufacturing, material majors should lay particular stress on

engineering materials,and other related professional students should have overall understanding on material, cold and hot working**.**

Rich course content and the limited class time will be conflict. In order to adapt to social development needs, many universities are to cultivate high-level, interdisciplinary talents as the goal, to give each student many compulsory and optional courses.These courses take up a lot of time, will inevitably lead to the reduction of professional and basic course class, which directly makes the teachers in the teaching process to reduce the content of teaching, and the consequences of students is what all don't understand, don't learn anything[2].

Less time of experiment teaching, the experiment of outdated equipment and lack of funds.Engineering Materials and Fundamentals of Mechanical Manufacture is a subject characteristic of practice,which need to match the theory of experiment courses to guarantee the quality of teaching,however experimental teaching gradually weakened, restricted the improvement of teaching quality, because of disciplines and specialties adjustment, teaching plan changes.At present, the following problems appeared in the process of experimental teaching:First, the students' autonomy has not been brought into full play, because of the lack of equipment lead to students can't free operating instruments;Second, limit for classroom time, students are not learning equipment operating instructions, cause them can't separate operation of equipment correctly;Third,students have no preparation experiment teaching material and don't know how to operate when they enter the laboratory;Fourth, the students lack of experimental interest，because they can not connect the experimental contents and actual production;Fifth, because of practical constraints, mostly in the verification experiment, almost no comprehensive experiments[3].

Teaching mean. At present, most colleges and universities use the modern audio-visual teaching means such as multimedia courseware, but there are still some drawbacks：(1)The teachers rely on the PPT too much .In the teaching process, many teachers especially the young teachers with less experience,in order to reduce the preparing time and making the detailed content of the PPT, thus ignoring the primitive teaching effect.The teachers just echoes what the book says,and undoubtedly turns people off.(2)Teaching method is not appropriate.It is necessary to integrate theory with practice and pay special attention to practice students’ ability of learning and training,but young teachers who lack of experience and skills often fail to do[4].

Teaching method. The current teaching belongs to the mold of traditional knowledge-giving, its form is difficult to guarantee the quality of teaching.One of the keystones in current teaching reform in higher education institutes is to facilitate the transit from traditional teaching to innovative teaching and students should transform from receptive study to innovative study[5]. In fact, foreign teaching method is varied, with very different in China, such as heuristic teaching method,discussion method,case teaching method, etc[6]. Teaching process is the interaction between teachers and students,students can ask the teacher questions or free discussion, even to solve the problems in field experiment by network video dialogue.Such as discussion method,students collect and organize material around the subject matter,and through observation, comparison, analysis and induction, reveal the causal relations between things,then participate in the discussion under the guidance of teachers.The above measures cultivate the students' ability of self-study and independent analysis.

The above three aspects is about the problems and shortcomings existing in *Engineering Materials and Fundamentals of Mechanical Manufacture* course teaching in professional machinery or related professional now.There is a problem worthy of repeated exploration and research that make students active learning desire and get more effective knowledge information by optimizing the classroom teaching and reform of teaching methods.

Discussion on teaching content reform

Manufacturing technology change rapidly, new materials, new technology and new technology emerge constantly in the field of industrial ,which make the teaching content more rich.It is imperative to deepen curriculum reform in teaching contents because of the fierce conflict between new and traditional teaching ideas, rich teaching contents and dwindling hours. Traiditional teaching

content including the composion of material, matrials manufacturing, material properties and performane as shown in Figure. 1

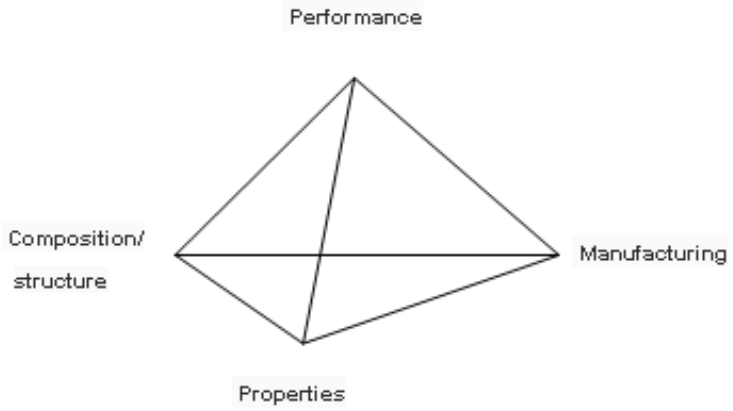

Figure. 1 Relationship between the contents

The reform of teaching content of theory. At present, The curriculum content system of Engineering Materials and Fundamentals of Mechanical Manufacture is established on the basis of all related disciplines, including Metallography, Engineering Materials, Heat-treatment Principle,Traditional Mechanical Processing Method, etc. The curriculum content system of Engineering Materials and Fundamentals of Mechanical Manufacture has been greatly enriched, and the choice of teaching content scope expanding,with the new technology, new materials and new technology constantly emerging[7]. The teaching content of Engineering Materials should be integrated into the following three parts, according to the principle of strengthen basic,highlight the key,focus on practical and widely applied.Part One is a introduction of material composition change rule and the relationship between the performance and organization,which is only given a brief narrative,based on guaranteeing the basic concepts and theory.Part Two should be focused on which mainly described the knowledge of material selection and the relationship between the mechanical design and manufacturing. Part Three mainly described the relationship between material and processing method, and how to improve the ability to formulate reasonable processing route.The curriculum of Mechanical Manufacture is divided in five categories: process analysis, materialselection, shaping methods, machining technology, production management. Besides, the content add the current advanced mechanical manufacturing knowledge appropriately, make the course more close to the practical engineering application.At the same time, reducing the teaching material of pure theory, increase the technology content, helps the students master the knowledge of mechanical manufacturing technology, improve the ability to solve engineering problems.

The reform of practice teaching content. The engineering practice is an important absolutely necessary the Engineering Materials and Fundamentals of Mechanical Manufacture,which aim at cultivating the students' practical and innovative ability.Therefore,a rigorous teaching system should be established，including experiment, practice, design and innovation.Experiment teaching should be to achieve the mutual infiltration in different disciplines, which aim at cultivating the students' integrated ability. Unfortunately,the current experiment mostly belongs to the verification experiment,the students can get the results of the experiment through step-by-step operation,without thinking,so students spending on experiment is not enough, lack of interest.Practice teaching cultivates students' comprehensive practical ability and quality through internal and external practice base.Design of practice teaching mainly is an important practicality link in teaching plan,which includes the course design and graduation design, the purpose is to strengthen students' mastery of theoretical teaching content, strengthen the basic skills of engineering design.Besides,Innovative teaching is a unified activity of learning taking students as main body and teaching taking teacher as dominant effect,which train the students' knowledge application and innovation ability.The above

four kinds of practice teaching fusion and cross each other, which build the new system including derives knowledge,develop the students' ability[8].

Discussion on the reform of teaching methods and means

The course of Engineering Materials and Fundamentals of Mechanical Manufacture includes basic principle and engineering practice, involving wide knowledge, which need to reform the teaching methods to adapt to the modern teaching development and improve the teaching quality and effect.

Cultivate the students' independent thinking and innovative spirit.Firstly, the teacher should put forward some questions for student in the teaching process,such as“what is the problem”"what is the background of the problem","what is the nature of the problem""what is the method to solve the problem",etc.These problems leave more thinking space for the students, which prompted them to seek answers, and cultivate their ability of putting forward questions, analyze and solve problems.Secondly, teachers must firmly grasp the students' curiosity psychology, set up other questions constantly， make the logical thinking activity of the teacher to resonate in the students, so as to realize synchronization of thinking, until solve the problem finally[9].

To integrate theory with practice. Theory and experimental teaching should be combined organically with engineering training and students realize the relation of engineering application,the basic theory of material and processing,so that the students' ability of applying theoretical knowledge to solve practical problems will be foster in the near future.

Pay attention to the combination of multiple teaching methods and use scene teaching to solve the problems. Engineering Materials and Fundamentals of Mechanical is a comprehensive technological basic course with much complicated theoretical and practical content,involving a large number of phase diagram and microscopic structure what make student feel puzzled.To solve the above problem, teachers can improve the students' learning efficiency and interest through the animation, the scene processing auxiliary video and network courses.For example,the crystal structure of a metal is more abstract and students cannot make out its meaning.However, teacher design a series of animation through the multimedia technology,express the crystal structure of the abstract with dots and lines which will guides the student to complete the transition from image thinking to abstract thinking,and make them learned this knowledge with pleasure[10].

Strengthen the construction of teachers and improve teaching quality.First, the youth instructors should enhance teaching training, be active in teaching and science researching practice, and continuously improve their teaching abilities and researching quality .Second, the teachers should adhere to the combination of teaching and research, drive the research with teaching, and promote the teaching with research.Third,establish and consummate the development and management mechanism of teachers, help improve the graphics teaching, implement the teaching reform,enhance the teachers' quality and level unceasingly[11].

Establish a novel assessment mechanism.The assessment mechanism has a direct guidance to learning,Which take multiple evaluation project to achieve better training purpose.Facing the course characteristics,flexible assessment methods are used rationally, which can eliminate the disadvantages of traditional test,such as emphasizing on book-knowledge and ingoring activity-abilities.At present, most colleges and universities in our country, a one-time examination model is still widely used, limit the students' interest in learning, innovative consciousness and ability,which causes “cramming before exam”. A comprehensive assessment methods that including the usual,experimental results and final exam scores can arouse the enthusiasm of students' autonomous learning, students can give full play to their own advantages, eventually achieve the goal of improve teaching efficiency and quality.

Curriculum development prospect

Series course of Engineering Materials and Fundamentals of Mechanical Manufacture is a technical basic course with a long history,which has played a significant role in higher engineering education and cultivates a large number of talents for China's socialist construction. The course as

an basic course of status will not change,and its teaching contents, teaching methods, teaching means will keep pace with the times.The structure of the course will be more fundamental, practical and interesting,which features of practice will be fully reflected in the near future.

Acknowledgment

The research is supported by the pilot project of professional comprehensive reform of general undergraduate colleges and universities in Jiangxi province(No.2013 GZC0028).

References

[1] Li Zhiyang, Huang Mingyu. Research and application of multimedia courseware of engineering materials and foundation of mechanical manufacturing course[J].Journal of Nantong Technology Institute (SOCIAL SCIENCE EDITION). 2004, 20(4):158-160.

[2] Jia Jihong, Ren Ying. Research on teaching reform of engineering materials and foundation of mechanical manufacturing[J]. Science Educaton. 2010, 27(6):44-45.

[3]Zhao Hanyu, Wang Dong, Li Yundong. Research on the experimental teaching reform of mechanical engineering materials[J]. Science and Technology Innovation Herald. 2010, 32 (3):245-248.

[4]Yu Zhong, Yue Zhonghui. Strengthen the class discussion teaching to improve teaching quality[J]. Journal of Mudanjiang Normal College: Natural Science Edition,2002, 17 (4): 59-60.

[5]Wang Zhangzhong. The teaching reform of engineering materials [J]. Journal of Nanjing Institute of Technology, 2001, 9(1): 48-50.

[6]Zhang Xiangyang, Jiang Huiqiong, Cui Huimin, Zhao Beilong. Reform and practice of engineering materials curriculum [J]. Chinese Staff Education, 2013, 16(7):141-143.

[7]Hou Yingke, Zhao Daxu, Cao Huanling, Xu Xiaofeng. Explore teaching reform of mechanical manufacturing basis [J]. China Electric Power Education, 2013, 20 (3): 68-69.

[8] Zhang Aimei. Discussion on teaching reform of the new period of the machinery manufacturing specialty practice [J]. Education and Occupation, 2008, (26):39-42.

[9]Liu Donghui. The reform and practice of engineering materials and machinery manufacture foundation [J]. Journal of Pingyuan University", 2004, 21(1):70-71.

[10]Zhou Yumei. Teaching method of engineering materials curriculum [J]. Science and Technology Information, 2010 13 (4):22-23.

[11] Xu Xianfeng, He Bolin. Mechanical engineering materials[M]. Being: Chemical industry press, 2010.