A Novel Teaching Mode of Mechanical Engineering Based on Compatibility Mode of Guidance and Giving Lecture

Mingming Xing*  
School of Mechanical Engineering  
Linyi University  
Linyi 276000, China  
xingmingming2009@126.com

Lili Zhou  
School of Chemistry & Chemical Engineering  
Linyi University, Linyi 276000, China  
zhoulili@lyu.edu.cn

Abstract—Considering the lack of undergraduate education with the tutorial system, the new teaching mode of undergraduate education with compatibility mode of the guidance and giving lecture is proposed. In this teaching method, the advantages of tutorial system and giving lecture are absorbed. Besides, some new institutions are adopted, such as perfect evaluation system of tutor, comprehensive management system of department and incentive systems of teacher and student. In new teaching mode, the need for applied career person with ability of mechanical engineering that meets economic construction and development is considered. The mechanical engineering talent of high-level, compound, and practical knowledge is trained by the aspects of engineering practice, technological innovation, engineering design and construction, etc. The new engineering teaching system is discussed, which is beneficial to improve the innovative ability in the practice and employment competition ability, but in the meanwhile which is a theoretical reference for teaching reform.

Keywords—Undergraduate education; Teaching mode; Tutorial system; Giving lecture

I. INTRODUCTION

Tutorial system derives its origin from New College, Oxford, which is established in 1380 by Bishop of Winchester William Wykeham. Professor of Will Grayburn Moore, St. John's College of Oxford, believes that there are three factors that the tutorial system is successfully used in College of Oxford, such as students’ individual difference, cooperation between tutor and student and unique attitude towards the knowledge [1]. In retrospect, based on the character formation, the tutorial system plays the important role in eight hundred years of Oxford’s evolution. With the rapid development of economic and cultural exchanges in the world, different universities carry out the credit system after Beijing University in 1910. However, under the influence of reforming the education system, the credit system is abandoned by different universities in 1952, and the academic year system is used. Therefore, the development of tutorial system is impeded. In 90s of 20th century, with the implementation of the credit system in different universities, the tutorial system has a rapid development.

Based on the Chinese government’s National Outline for Medium-Term and Long-Term Educational Reform and Development 2010-2020, the essential requirement of the educational work should be the talent-cultivation-oriented for universities, the strong impetus for Educational Progress should be reformed and innovated, and core task of education reform should be improved quality. Follow the wave of educational reform, there are a bit of challenges for experts and scholars, especially universities. The problems are investigated and discussed in depth, which is type of education and method of education. Li Zhiyi, a president of Dalian University of Technology, proposes that the result-oriented education reform of higher engineering education should focus on three conversions, namely, conversion from subject-oriented to target-oriented; from teacher-centered to student-centered and from quality supervision to continuous improvement [2]. Li Liguo, a professor at China Renmin University in Beijing, points out that Chinese higher education can successfully overcome the dilemma faced by developing countries in popularizing higher education and develop into a modern higher education with Chinese characteristics [3]. Qi Yeguo, a professor in East China Normal University, advises that the construction of an undergraduate teaching quality guarantee system makes a response to society’s worry or doubt about undergraduate educational quality, and fully draws on methods used in quality control of industrial and commercial enterprises[4]. Li Peigen, a member of the Chinese Academy of Engineering, points out that the quality of the engineering talents can be guaranteed by the practical teaching of engineering education [5]. He makes a systematic summary on the problems present in the practical teaching of undergraduate engineering education from five aspects: the goals of practical teaching, the design of practical teaching system, the methods of practical teaching, conditions of practical teaching and the teaching staff and then the causes of these problems are explored form several perspectives, such as traditional vulture, practical teaching concepts, education mechanism, the input of educational resources, etc. He Chaoyang thinks that the inverted classroom can contribute more in students’ learning autonomy, team-work commitment, creative spirit, classroom atmosphere and internalization of knowledge, which offers some reference for the higher engineering education classroom to carry out inverted classroom teaching in our country[6].
Zhou Guangli, a PhD supervisor of Renmin University of China, points out that the concept of scholarship of teaching is not only a powerful means for faculty evaluation, but also an important index to evaluate the core competence of university. He thinks that scholarship of teaching should be a priority in the strategy of university [7].

In recent years, the undergraduate education and reform are explored in different universities. The tutorial system of undergraduate education is a teaching method, which deals with the challenge of undergraduate education. According to the statistics, the reform of general education is carried out in Fudan school build in 2005. The training system of general education is built with core courses and college-tutorial system [8]. However, there are some troubles when the reform of general education is put into effort in Fudan University. For example, besides the teaching organization should be further improved, there are difficulties in carrying out college-tutorial system. According to a census report of the tutorial system of Fuzhou University in 2012, the students’ satisfaction with the tutorial system is ordinary [9]. And there are some problems, such as the ambiguity of boundaries of tutor’s responsibility, the simplification of tutors’ guidance method and content, and the lack of tutor evaluation systems. In conclusion, there are some problems in Undergraduates Tutorial System like shortage of tutors, unclear definition and formalism. Reforms must be done, which must lies in the development of independent thinking, the focus on instructional system, instruction through the whole process, tutor qualification and enhancement of tutorial system [10].

Guo Yong, a professor in Tsinghua University, indicates that when Chinese universities tried to pursue the college-tutorial system. In conclusion, there are some problems in Undergraduates Tutorial System like shortage of tutors, unclear definition and formalism. Reforms must be done, which must lies in the development of independent thinking, the focus on instructional system, instruction through the whole process, tutor qualification and enhancement of tutorial system [10].

At the same time, the tutorial system will be included in the training program, and should be adopted by teaching organization and operation system. Besides, in order to reduce the burden of students and increase student independent thinking time, the total credit of talent development will be reduced.

2) Construction of the tutor team
In order to resolve source shortage of tutor team, the teacher resources of both inside and outside the universities should be integrated. Firstly, the evaluation of on-campus tutor should be selected. With selecting on-campus tutor, the responsibility and job skills are the basic requirement. The professional expertise of tutor should be a major consideration. Besides, the young tutors should be trained by the guiding ideology, guiding principles and particular skills. Secondly, the selection of out-campus tutor should be considered. In order to strengthen the practice teaching and enhance students practice manipulative ability, the practical guidance teacher and base should be selected to reinforce the plan of tutorial system. At the same time, the retired teacher and academy student are all selected to and support tutor.

3) Management system
The institution is a great treasure which earlier generations have given us. The education system of tutorial system needs a series of support system, such as the institution of tutor selection and elimination, usage and management of research funds, tutor’s laboratory, credit system, evaluation system of tutor. Based on above facts, the management system should be made with advantages of each college and current policy.

B. Guiding system of entire process trace

1) Research exhibition of tutor
The research of tutor is internationally frontier topic, which is an important subject for tutor system. The schematic of research exhibition is shown in Fig.1. The purpose of research exhibition shows students some knowledge, such as the origin of the current study, the current situation and prospect of the study both at home and abroad, the relation between research subject and specialized courses and the benefit or effect of current study. With above knowledge, the enthusiasm of student is motivated. And the selection of tutor is beneficial for acquire knowledge and playing special advantage.

At the same time, the tutorial system will be included in the training program, and should be adopted by teaching organization and operation system. Besides, in order to reduce the burden of students and increase student independent thinking time, the total credit of talent development will be reduced.

II. TEACHING SYSTEM WITH COMPATIBILITY MODE OF GUIDANCE AND GIVING LECTURE

A. Management responsibility of department

1) Teaching institution of tutorial system
First, the work of tutorial system should be taken seriously by Dean's office. The work of tutorial system is carried with teaching job, and is an indicator of teachers' professional evaluation. And thus, the worker morale of tutor is motivated.
2) Two-way choice between tutor and student
The spring, the day is morning. The first semester of student is an important stage of life goals in college. Therefore, the tutor should be selected firstly, and the development program should be made with direction of tutor research and professional advantage. The deadline of two-way choice is the final stage of the second term. However, considering the special situations of tutor and student, the selection can be adjusted in third term. To be true, the specialized courses and practical training will start in the third term, if the selection is changed, the course and learning process will be affected. Therefore, the third term is the last adjusting time. The schematic of two-way choice is shown in Fig.2.

Fig. 2. The schematic of two-way choice between tutor and student

Considering the change in learning style, living environment and human-human interaction, the guidance of tutor will start as soon as possible in first term. The overall course is as follows.

a) Self-cultivation education
The self-cultivation education of freshmen and sophomore is foundation in first two years. Considering their studies and practice, the special knowledge education and comprehensive quality will be unified together by tutor. The different abilities are all obtained, such as right learning method, self-control approach, self-cultivation, professional ability. For example, based on the direction of research and specialty training plan, the professional classes are selected by tutor. The knowledge what part of professional class has relationship with research subject is known by students. The key knowledge and learning goal of a professional class is clear. And students should know that the study of computer major courses is not abstract theory and is great help to solve scientific problems.

b) Improved professional education
The improved professional education is the core of undergraduate education in the third and fourth term. After previous two years, the professional education will start at this stage. The education contents include the method of academic research, reading references, exploration of scientific questions and the problem of master candidates and job hunting. Firstly, students are guided to carry out social research related to scientific research, literature reading, data collecting, introduction to analysis software, etc. Secondly, making


