

A Study of the Practical Teaching System of Mechanical Engineering on Theory-practice Integration Model

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ABSTRACT: This paper proposes the practical teaching system of mechanical engineering based on theory-practice integration model due to problems such as the separation of knowledge transfer from skills training, the lack of depth in school-enterprise cooperation and the insufficiency of practice and innovation. Under the guidance of the system, students are trained to research, develop and create in a deep school-enterprise cooperation model.

KEYWORD: Theory-practice integration; Mechanical engineering; Innovation; School-enterprise cooperation

1 INTRODUCTION

Mechanical engineering is viewed as an important symbol of the level of development in China's science and technology in the key period of the country's economic development. In the 21st century, China has become the world's big yet not great mechanical manufacturer whose development fails to meet the demand of the national economy, which requires in large part application-oriented talents of mechanical engineering. However, in the long run, enterprises are more likely to turn to high-level compound talents of creativity and application [1]. Therefore, it is the training of such talents that will bring colleges and universities both challenges and opportunities. The training will be only effective by creating an administration that combines theory and practice, enhances the interaction between theory and practice, develops a new school-enterprise cooperation model and builds the practical teaching system.

2 PROBLEMS IN THE PRACTICAL TEACHING SYSTEM OF MECHANICAL ENGINEERING

2.1 *The separation of knowledge transfer from skills training*

Mechanical engineering is a subject that involves the analysis, design, production and maintenance of mechanical system by using the law of physics, studies all the theories to solve practical problems in the development, design, manufacture, application and repair of various machines and emphasizes the

integration of theory and practice[2]. Many colleges or universities at present have talents rich in theoretical knowledge yet poor at hands-on skills. The innovation of machinery is inseparable from an organic bond of the practice and theory. Knowledge teaching model stresses a logic transfer by laddering and combining. Although knowledge can be transferred theoretically to students, they forget theories while being trained as such transfer always separates theory teaching from practice in colleges and universities with ignorance of the fact that creation comes from practice.

2.2 *The lack of depth in school-enterprise cooperation*

The school-enterprise cooperation model is of great significance as it improves the quality of the students, boosts the practical cooperation between the university and the company and cultivates talents for the society, which benefits both the two parts of the collaboration. The model manifests itself as the introduction of the enterprise into school, Sandwiches courses with working and teaching taking turns, interactive model and ordering cooperation. Though they have solved part of problems of practice and employment, these models are yet to be achieved by a deeper cooperation as enterprises are not so cooperative which damages external driving force for the cooperation to share practical faculty, scientific research and equipment[3-4].

2.3 The insufficiency in practice and innovation

So far, students in the practical system of this subject have made great progress in the command of mechanical engineering skills which includes technical process, frock clamp, ergonomic, information processing, automation and vehicle engineering and in the operational problem-solving of theory studying, assembly and interface. But students have a poorer performance of innovations of papers, patents and contests^[5].

3 THE CONSTRUCTION OF TEACHING SYSTEM OF MECHANICAL ENGINEERING BASED ON THEORY-PRACTISE INTEGRATION MODEL

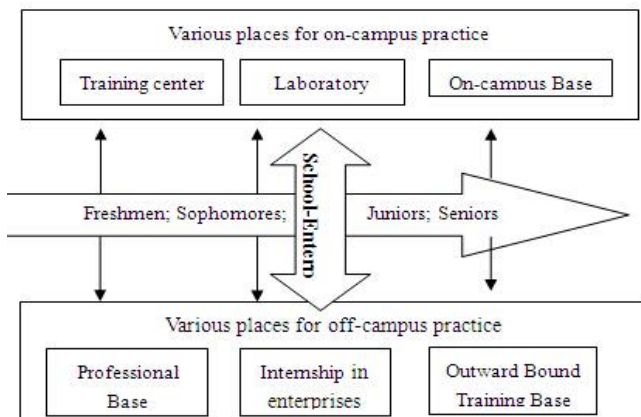
In order to optimize the teaching system of this subject, our college is intended to build a package of places for practice upon theory-practice integration model and move part of theoretical teaching to the center in which students can practice while learning, such as correlating theoretical and practical teaching of engineering design, training, operation, maintenance, production and development. As shown in picture 1 of practice and teaching system upon the theory-practice integration model, the interior training center, closer to the facts, is more convenient for teaching than off-campus practice base as the center produces an engineering a fully functioned environment with real situations in which the theories and practice could be taught flexibly. The center is built as a training place as well as a base for industry, university and research by establishing a healthy teaching system. Besides, it will exhibit to students models and entities and offer them various skills of dismounting, analyzing, testing, designing and doing experiments as a place for either extracurricular scientific and technological activities or contests of mechanical or electronic designs, ushering students into a real space where they can put their creation and imagination into practice with their talents.

3.1 The establishment of a institute based on theory-practice integration model

This institute has its major tasks as follows: making rules; coordinating relationships during the practical teaching; classifying types of internship positions according to students' four grades; arranging and modifying the schedule for practice; implementing all the models for school-enterprise cooperation; monitoring the quality of the whole practice and testing its effects; distributing places and teachers; managing the funds; rewarding innovative projects; balancing between basic theoretical courses and courses under theory-practice integration model; comprehensively coordinating every part of practical teaching such as experiments, internships, on-campus and off-campus training, social practice, course designs, graduating designs, internship post-replacement, productive work and social research. If the university manages its practical teaching system via an effective mechanism, the students will receive well-organized and valid practice. For instance, they will be arranged two weeks of metalwork and another two weeks of numerical control training during their second year. On the third year when they are juniors, an internship of eight weeks in the enterprise will be put into practice while the ten-weeks-long graduating internship will be carried out on the large school-enterprise cooperation base.

3.2 The integration of thinking and practicing with an emphasis on innovation training

Theory-practice integration model must solve problems from a practical teaching mind to help students form a practical view with knowledge and practice in unity and be able to create and develop based on theories and experiences they have learned and adopted. Talent training programs shall meet the economical and social demand in the future for engineering and technique talents engaged in the front line with the social demand as the guidance, the engineering techniques as the major principle and the yield of R&D-type engineers of basic qualities as the training objective[6]. Students are trained to research and develop as they can attain basic knowledge and theory over a shorter period than the acquisition of skills which can only become perfectly applied over repeated operations and training. Only with the integration of skills and knowledge can students research and develop new techniques and products of mechanical engineering. Therefore, the college or university should incorporate most of its engineering courses into practical teaching system to fully let students think and practice emphasized on innovation training. Thus only in this theory-practice integration system can there be a high end platform built to meet the demand of the society.



Picture 1. The practice and teaching system upon theory-practice integration model

3.3 *The strengthening and expanding of school-enterprise cooperation model*

The cooperation model has become merely a form due to the fact that enterprises are less willing to perform it with universities as they do not get the talents they need to solve practical problems after a wide array of financial, human and material resources have been invested. Thus a cooperation model between universities and enterprises should presuppose a win-win goal due to which the university and enterprise jointly educate talents, manage the whole process and share happiness and responsibility. For example, the university can generate innovative talents and bring in advanced technology and capital while the enterprise can absorb satisfied talents by the cooperation to help it solve practical problems. Therefore, the cooperation is better to be carried out under a win-win strategy ideal for both the university and enterprise.

A further cooperation with major companies: Zhong Ding (Holding Group) Co. Ltd co-constructs with our university the National Off-Campus Training Base for Undergraduates. On the basis of a five-year cooperation between the Enterprise and the School of Mechanical Engineering, the corporation offers two-master teachers with corporate backgrounds, teaching facilities for training and experimental teaching reform and any condition for students in major of mechanical manufacturing or automation to receive off-campus specialized practice. We shall keep in a deep cooperation with major corporations.

University-industry-research cooperation: it helps improve and innovate the practical teaching of majors of mechanical design, automation and mechanical electronic engineering with the training for students' practice and innovation as the core, thus breaking a traditional model under which experimental teaching is subordinated to theoretical teaching. Students' supervisors can incorporate their projects with enterprises into the practical teaching system. With industrial projects as the orientation and technical service platforms as the objective, the university and enterprise work together to build a multifunctional training base which integrates training, practice and employment in pursuit of small-volume yet high-tech production. The two institutes aim to construct a long-term sustainable mechanism including enterprise customized training model in which a board is established for joint education and management of the students by sharing happiness and responsibility. The mechanism is to strive for further teaching reform of comprehensive professional training and practice by acting out both practical teaching and vocational training.

4 CONCLUSION

The practical teaching system of mechanical engineering majorly fosters students' ability of research and development on this subject within a deep school-enterprise cooperation model under the control of the institute built upon theory-practice integration in order that mechanical engineering is able to generate powerful innovative manpower for the country to be a world's great manufacturer of mechanism.

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