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Reform and Practice of Engineering Training Courses based on Outstanding Engineer Cultivation

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Abstract

The engineering training takes a very important role in higher education that raises students in the spirit of innovation, Engineering consciousness and practice ability. To meet the requirements of "Outstanding engineers training project", Researches and explorations on reforms of the teaching content, teaching methods and teaching means of the engineering training have been carried out, which help to improve the students' engineering consciousness and ability to innovate, develop more innovative practical talents.

Keywords

Engineering Training; Outstanding Engineers; Teaching Reform; Innovation

Introduction

"Outstanding Engineers Training Project" is a major reform project to carry out "the outline of national medium and long-term educational reform and development plan (2010-2020)"and "the outline of national medium and long-term talents development program(2010-2020)",which will also play an important role in the progress of turning China from a great nation of engineering education into a powerful one. "Outstanding Engineers Training Project" is aiming at cultivating a large number of high-quality engineers with outstanding innovation ability to meet the requirements of economic and social developments. This plan makes a very important role in the improvement of the quality of engineers' training.

One major feature of the "Outstanding Engineers Training Project" is to strengthen the ability of students' engineering consciousness and their spirits of innovation. Cultivating and enhancing the ability in engineering and innovation is the core of the plan, which requires students to learn through a variety of practical training to develop the basic practical skills. It enables students in engineering not only the ability to possess a solid foundation of engineering practice, but also the ability to solve engineering and technical problems.

As an engineering practice education infrastructure set up in campus, Engineering Training Center plays an important role in outstanding engineers' cultivation. Engineering training is one part of practical teaching links and one of the essential technical fundamental courses during engineering learning period, which shoulders the important task in enhancing undergraduates' engineering quality and practical ability, and cultivating the modern engineering talents with compound knowledge, applied technology and high creativity. During this practical teaching process, the spirit of innovation and innovative ability are promoted. High-quality students with good spirit of innovation, engineering consciousness and practice abilities are trained through the way of practical product design and manufacturing, which impel students to develop engineering practice ability, innovation and engineering awareness from books to practical engineering training.

GuangDong University of Technology (GDUT) is one of the second pilot universities among the "Outstanding

Engineers Training Project". The first "outstanding engineer class" in GDUT was opened in 2012, which took the first step of outstanding engineering training. In our engineering training course, Researches and explorations have been carried out orientating students' cultivation in the "outstanding engineer class" in mechanical engineering, GDUT. Reforms of the teaching content, teaching methods and teaching means of the engineering training have been studied and carried out, which help to improve the students' engineering consciousness and ability to innovate, develop more innovative practical talents.

Reform on Teaching Mode

Most undergraduates don't have any experience of engineering training before their entering into university; therefore they are very lack of engineering awareness and engineering knowledge. It is suggested that to enhance the spirit of innovation and innovative ability of students, training should be started from scratch, such as the fundamental knowledge and basic techniques. According to the characteristics and targets of the outstanding engineers training project, a customized training plan for the "outstanding engineer class" in mechanical engineering was established, which includes three training stages, i.e. basic skills training, comprehensive ability training and innovative capability training.

Basic Skills Training

During basic skill training stage, students learn how to operate relevant instruments and equipments to improve their practical skills, thus lays the foundation for the subsequent two stages of comprehensive ability training and innovation capability training.

The training mode is mainly carried out on the way of learning various kinds of unrelated manufacturing techniques respectively. The training content of each technique is independent. This kind of training mode is that at first, instructor operates equipment under specification and demonstration on-site, then student operates the equipment according to the given drawings and process under the guidance of instructor beside. This level of teaching is teacher-centered, and the training content and training methods are determined in advance by teachers and instructors, focusing on training students' basic skills of operating.

Comprehensive Ability Training

The second stage is the comprehensive ability training. To further help to enhance the students' comprehensive ability, project-based learning (PBL) mode is adopted. PBL mode is an effective method to transform the engineering training from teacher-centered to student-centered through the way of transforming the training content from the respective manufacturing technique learning to project-centric problem solving. The content of the project can either be the students' cafeteria or teacher's assignment. To accomplish the project, students should finish all the work from the product design, process design to the manufacturing and assembling of the product all by themselves. This training mode can greatly initiate the students' passion in active learning, therefore a more in-depth understanding of the manufacturing process is achieved, and the comprehensive abilities of the students are obtained during training.

Innovative Capability Training

In order to further enhance students' capability of innovation, the third stage - innovation ability training was set up. This stage of training is completely open, and training content is completely determined by the students themselves. The training content is usually related to extracurricular scientific and technological activities, various kinds of competition and related projects. As there are no any constraints, students can greatly play their own initiative to training.

They can organize various innovation teams and utilize various opening innovative bases to accomplish the innovative project, so that students have sufficient room of innovation training. Innovative capability training is one kind of competition driving training, which can be carried out combining with various kind of disciplines contest. In recent years, students in GDUT who participated in contests such as the "Challenge Cup", "mechanical innovation designing competition" and "project of comprehensive ability training and competition" have gotten

good grades through this way of training.

Flexible Teaching Methods and Means

Based on the reform of teaching mode, flexible teaching methods and means are adopted in the process of teaching.

Introduce Modern Education Technologies

Traditional way of engineering training is usually carried out in a stationary workshop with specialized equipments. With the development of science and technology, new technology and new processes are constantly emerging; therefore engineering training should keep pace with this development, this means the training content need to increase correspondingly. As several advanced manufacturing equipments are so expensive and the updating process of equipments is so quick, it's difficult for us to purchase or exchanging a large quantity of equipments, therefore the content and quantity of these kinds of equipments cannot meet the needs of engineering training to make every student have a full hands-on opportunity, thus hinder the trainee from consolidating and deepening knowledge they have learned. To solve this problem, modern education technologies are introduced and virtual operation software of CNC machine tool is self-developed and distributed on the internet. Students can easily operate the virtual CNC machine tool using this software in computer on internet. Therefore, students can not only get physical training at the time scheduled in workshop, but also practice using virtual operating software in their spare time. The constraints of time and space are broken. Using of virtual operating software can not only save the cost of equipments and training, increase the students' practice opportunity, but also can help to adjust the training contents to keep pace with the development of science and technology.

Opening Training

The content of traditional engineering training is relative unchangeable. No matter what the major, how long the training time, the training schedule are arranged under the same criteria and the students have no plenty of room to choose their training content but get passive training. In order to further improve the engineering practice and innovative ability of the outstanding engineers class students, enhance their enthusiasm for training and make training more effective, A complete open should be done in terms of time, training content and workshop sites. Training programs can be freely selected by students themselves after theie completion of the compulsory training contents. Students should complete all the selected training programs and product-making works within the prescribed time, under the guidance of the teachers and instructors only on operating skills.

Project Driven Training

Traditional engineering training is a passive training period. The training type, contents and timetable are all designed by teachers and the contents of training have little changing for ages. According to the results of investigations and teaching symposiums, students rarely know what they should study and why they should study during training. Consequentially, students' comprehensive capability cannot improve greatly. Therefore, project-based learning (PBL) training method is adopted, in which students can design parts, make manufacturing process and assemble parts into product according to their specific program independently. It will make the training more interesting and motivate students' incentive. After this kind of training, students will have a profound recognition of the thorough manufacturing process.

Conclusions

Engineering training is a practical fundamental course and it has a paramount important influence on Outstanding Engineer Cultivation. This course will provide a suitable training environment to enhance students' spirit of innovation, engineering consciousness and practice ability through researches and explorations on reforms of the teaching content, teaching methods and teaching means of the engineering training.

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REFERENCES

[1] Yu Zhaoqin, Wu Fugen, Ding Zheng,Deng Haixiang, Guo zhongning. "Research and exploration of the mode in mechanical engineering training method (in Chinese)." Laboratory Research and Exploration (8)2010,:271-273.

[2] Luo Zhiyong , Zhang Shengtao , Zhou Xiaomei , Deng Yin. "Exploration on the innovative practice ability training of students in colleges and universities (in Chinese)." Experimental technology and management 7(2009):28-30.

[3] Fang Man, Chen Dejun. "Strengthening the construction of the student's science and technology innovative base, promoting the cultivation of innovative talents (in Chinese)." Experimental technology and management. 8(2009):20-22.

[4] Hui jizhuang, Liu haiming, Zou yake. "Exploration of construction of modern engineering training center and training mode (in Chinese)." Experimental technology and management 3(2009):115-118.

[5] Yang dan. "The comprehensive cultivation of students' innovative practical ability measures (in Chinese)." Laboratory Research and Exploration 7(2011):1-5.

[6] Yang qi, Li Shulian. "Progressive training students' innovation ability in engineering training (in Chinese)." Journal of Anhui University of Technology(Social Science Edition) 3(2008):123-124.

[7] Han Rucheng. "Exploration and practice of training the ability of engineering practice (in Chinese)." Chinese University Teaching 6(2009):77-79.

[8] Wang Xiaohong, Zhu Xiaoming. "The research and practice of the teaching mode of modern engineering training (in Chinese)." Experimental technology and management, 6(2009):118-120.

[9] Yu Zhaoqin, Peng Duan, Wu Fugen. "Strengthening the construction of engineering training base the cultivation of applied talents (in Chinese)." Research and exploration in laboratory 6(2009):274-275,327.

[10] Peng Pengfei, Ren Xiongwei, Xiao Jinshi. "The implementation of autonomous research and experiment teaching and cultivating innovative talents (in Chinese) ." Research and exploration in laboratory, 5(2011):107-109,149.

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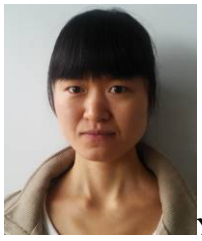

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