Developing an Innovative and Creative Teaching Model for Engineering Education of College in China

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Abstract. The graduates in the teaching mode of light chemical engineering of college in China cannot meet the requirements of technical personnel for mass production of modern factory and the overall innovation ability is not enough. In order to change this situation, it is necessary to reform the teaching mode innovation. Grasping of knowledge and technology application are the primary goal of engineering teaching. How to make the students accept the boring book knowledge and timely transform into productivity is the focus of the current teaching. In order to cultivate the professional personnel having theoretical level, innovation ability and practice ability in line with the production factory, this paper will explore and construct a novel teaching mode from the two aspects of classroom teaching and practical teaching.

Introduction

College engineering education has become the topic of increasing interest in technology education circles. It can provide content of Technology and Engineering for the large industry, which is in the interest of technology educators at different specialty fields as it builds the bridge between students and employees. Given this growing interest it is not surprising that there is a need for present development in modern society that show how college engineering education could be conceptually founded and practically given shape. Therefore the exploring of novel engineering teaching mode is imperative[1].

The Teaching Problems in Current Light Chemical Engineering Teaching

The Teaching Content is Updated Slowly and Boring and It is Difficult for Students to Understand

Nowadays, the common problems in colleges and universities are the professional training materials are relatively old and the renewal of knowledge is slow. Therefore what the students have learned in the classroom are not adapted to the needs of the factory production and the theory is out of line with the factory. This phenomenon has led to the trained students became short theorists who are unable to adapt to the needs of social production.

Meanwhile the content of teaching material is boring and the theoretical knowledge is emphasized, therefore it is difficult for students to understand. The teaching of light chemical engineering is intuitive and visual. Since it needs to implement the visual things into the textbook, the teaching will inevitably become boring and abstract without actual reference and it is difficult for the students to understand. And then it will produce a chain reaction resulting in poor learning. So it cannot effectively guide the practice.

The Teaching Method is Dull and Then the Study Enthusiasm of Students is Not High

The traditional classroom teaching mode is relatively inflexible. In this way, blackboard and textbook are the main body of teaching information. It cannot provide images, audio and video information of vivid and intuitive. Furthermore the teaching method is single. During the teaching
process the teachers give a lecture and the students only simple to listen, thus the teaching effect is inefficient. With the use of modern teaching tools such as network and multimedia, many teachers are able to use multimedia courseware to explain the knowledge, which can effectively increase the visual image. But many teachers did not grasp the true meaning of multimedia lectures and failed to fully tap the various auxiliary tools to effectively improve the teaching effect. If the teachers just simply put the teaching material to the PPT file and let the students through the computer projection technology to browse the textbook knowledge, the enthusiasm of the students can also not be motivated.

**The Practice Courses is Fewer and the Combination between Theory and the Practice is Poor**

At present, the professional teaching of light chemical engineering of Chinese colleges and universities is mainly theoretical teaching in classroom. Practice training for the students is mainly implemented after work. Although some schools have realized the importance of practice teaching, the practice courses are less and only 1-2 weeks of production practice and 4 weeks of graduation practice are set. It is difficult for students to achieve the effective transformation of theory and practice during so short practice time. Moreover the serious shortage of internship funds has affected the reasonable and effective arrangement of the practice and hindered the effective implementation of the transformation of theory and practice. In addition, the laboratory experiment and the allocation of resources is less and then the students have few opportunities to go into the lab. And experimental supplies and resources cannot be guaranteed. It is not good to exercise the practical ability of students, but also affect the implementation and verification of the creativity of students, thus affecting the students' innovations and practical abilities.

**The Innovation Consciousness and Innovation Abilities of Students are Poor**

As a kind of practical and technical subject, the stronger sense of innovation consciousness and innovation abilities for students majored in light chemical engineering is required, which cannot be fulfilled during the boring classroom teaching. Nowadays as a result of lack of practice training, the cultivation of creative spirit and ability of students is negatively affected. Although the network will provide students with a lot of new originalities and ideas, the void theory cannot be translated into reality. This shows that it is urgent to reform the teaching system of light chemical engineering.

**Construction of Teaching Innovation System for Light Chemical Engineering**

**Reform and Innovation of Classroom Teaching Mode**

*Set up The Training Plan According to the Professional Characteristics.*

Light chemical engineering teaching and training programs can use a similar "1+2+1" mode. The first year is to strengthen the basic knowledge teaching such as English, computer and so on, cultivate solid English skills and computer skills, so as to freely access the relevant professional development at home and abroad in a timely manner with international standards. The second or third year is to strengthen the professional education of students through the explanation and infiltration of professional knowledge in multi-level and multi angle and increase the intensity of laboratories opening to offer more hands-on opportunities for students. During the four years the students should be given more free time, so that they have sufficient time to enter the factory for the production practice and graduation practice, to realize the combination of theory and practice and provide two-way choices to students and entrepreneurs. It can also lay a foundation for the students to work smoothly later.

According to the training objectives of the students, they are expected to smoothly read foreign language professional information, skillfully use the Internet and the library network to look up reference materials. They should master solid professional knowledge, actively participate in scientific research during the period of school and focus on training the operational abilities. Engage students in exercises related to assembly line mass production. To achieve these objectives, students were introduced to the principles of Lean manufacturing through various pedagogical
activities such as classroom instruction, laboratory experiments, hands-on exercises, and interactive group work[2].

**Continuous Reform and Improvement of Teaching Content.**

The old teaching content is a key factor that affects the teaching effectiveness of light chemical engineering specialty. It is necessary to add the latest achievements in the teaching field to the teaching contents in time, to adapt to the new situation of the development of the society, to timely preparation of new materials and new materials with a high level of development of science and technology achievements and timely adjust and update the content of practice teaching according to the requirements of social employment, education level and the regional economic development level. At the same time, the compression of class hours, reduction of required courses, expanding the proportion of elective courses and increasing the proportion of practice training are also needed. The practical ability and innovation ability of students can be effectively improved by updating the teaching content in a timely manner and increasing the proportion of practice teaching.

**Organize Teaching in a Flexible and Diverse Way.**

In order to organize the teaching rationally, we must first clarify the status of teachers and students. The teaching subject should transform from teachers only into both teachers and students. Differences of Chinese nationalities and regions should have been come into consideration, also, in terms of their classroom engagement and academic outcomes, are not surprising, given the diversity of experiences there[3]. In the premise of mastering the main teaching direction by teachers, the students will actively participate in classroom teaching as a result of giving full play to the subjective initiative. Their independent thinking, exploration and innovation ability will be enhanced during the process of discovering and solving problems.

The boring teaching way of “cramming education” should be changed and the modern teaching means such as multimedia can be introduced to improve the visualization of teaching effect. In the use of multimedia teaching, the knowledge in the textbooks is not directly moved to PPT, but using a variety of techniques such as video clips, editing, to move the actual operation of the factory to the classroom to facilitate the students understand the boring lectures.

When organizing the classroom teaching, the traditional model during which the teachers explain and the students listen should be abandoned. The enthusiasm of students can be fully mobilized and their potential can be excavated by group discussion and report to make the students actively into the teaching activities. The understanding of knowledge can be deepened and the corresponding ability can also be exercised during the process of looking up materials, group discussion, preparation of speaking material and giving a lecture.

If a course can be taught by several teachers to complete, it is not only to ensure that each teacher can teach the best part of the wonderful explanation to the students, but also to avoid the aesthetic fatigue of students to improve learning efficiency.

**The Reform and Innovation of Evaluation Methods.**

Change the traditional "examination paper" assessment model, the evaluation of knowledge can be comprehensively examined by the classroom performance, hands-on practice ability, innovation ability, examination results.

Classroom performance including teacher interaction, group discussion, oral report results, accounting for 30% of the total. Practice examination focuses on students’ skills in the basic operation skill operation, case analysis, achievement ratio is 20% of the total. The proportion of exam scores accounts for 50% of the total score.

**Reform and Innovation of Teaching Practice**

Light chemical engineering specialty is of professionality and practice. Practice teaching is an effective way to achieve the theory and practice docking and transform the theory into productive forces in a timely manner. In order to change the smaller proportion of practice teaching in the current situation in the whole teaching process, we should actively explore new teaching practice mode.
Practice Teaching Adhere to the "Coming in, Going out" Principle, Strengthen the Corporation between School and Enterprise.

There are three forms for “coming in”. One is to hire engineers or technicians in enterprises as part-time teachers. The frontline of production operations and development prospects can be vividly lectured to the students. The specific production process can be played in the form of video playback technology and solve the questions of students. Therefore the students can have a visual image of the professional knowledge, so as to clear the professional learning objective, clear direction of development and improve the initiative and enthusiasm of learning.

The second way is to invite the successful entrepreneur or outstanding alumni to give school lectures or recruitment. In the premise of the promotion of enterprise culture and development prospect, enable students to understand the importance of learning professional knowledge, enhance the enthusiasm and initiative of professional learning. Meanwhile the business school recruitment also provides a power to the low grade students to promote their efforts to learn professional knowledge and lay a solid foundation for the smooth entry into the unit.

The third way is to attract outstanding corporate scholarship. Enterprise scholarship is not simply to reward funding for outstanding students, the key is to enhance the enthusiasm of students in professional learning through this form and produce benign competition to race each other. Meanwhile professional scholarships for students can provide funds to support the experiment in the laboratory and further improve the practice ability of students.

“Going out” is to extend the classroom to the first line of factory in the form of internship outside campus, practice and training. The proportion of practice courses in the training program and curriculum arrangement should be increased. It is better to start from the professional teaching and the corresponding practice course should be arranged in each semester to consolidate the classroom teaching effect. During the whole length of education, at least 6-8 months for factory or school practice training must be guaranteed. The relation between factories and schools or professional teachers should be strengthened to expand the scope of practice base. As a result of apprentice training, production practice and graduation practice, during the period of professional learning each student has the opportunity to go deep into the first line in each semester to achieve effective combination of theory and practice and enhance the quality of teaching.

Strengthening the Construction of Laboratory in the School to Provide Students with More Opportunities to Practice in School.

The opportunities of practice for students can be added through the increase of laboratory construction and the capital investment of teaching practice, and as far as possible to attract the social support for the expansion of the laboratory scale to accommodate the increasing amount of laboratory. At the same time, adequate laboratory technician should be equipped and their training should be enhanced in order to make the experiment guidance to students. The professional teachers should also arrange a fixed time for students to do experiments in laboratory guidance and answering questions.

In short, in order to improve the comprehensive level of students majoring in light chemical engineering, the original mode of classroom teaching and practical teaching must be explored to change and a reasonable training program must be set. Since more autonomy will be given to students, they can actively participate in classroom teaching and both their practical ability and innovation ability will be improved accordingly through the practice of in-school and out-school practice curriculum.

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