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# The Research and Practice of Collaborative Teaching Model for “Creative Engineering Design Team”

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**Abstract:** This paper proposes a new type of Collaborative Teaching Model (CTM) for “Creative Engineering Design Team” (CEDT) in higher education. It is main problem that CEDT want to train the college students in comprehensive ability. At present, their abilities in cooperation and communication, professional work, innovation practice, transaction management and social adaptation etc. are common problems in current college education in China. CEDT try to explore a method to cultivate the students’ ability with a new teaching model. In traditional teaching model, in a course, only one teacher has to face many students. CTM will try to change this type, and should have several teachers to complete a relative complex engineering project in collaborative mode. Therefore, study how to design curriculum system to reform CEDT teaching goal, analyze CEDT how to adapt to the requirement of engineering student professional training, or put forward new requirements. To meet the needs of enterprises and social talents, CEDT project design will be the direction of efforts. Summary of CEDT practices in the past few years, some methods, problems and conclusion will be drawn.

**Key-Words:** *Collaborative teaching model, Creative engineering design team, Student professional training, Education reform, Higher education, Comprehensive ability*

## 1. Introduction

### 1.1 Higher Education Scale and Problems

At present, the conflict of talent training is obvious in higher education of China. Our education faces a serious problem, talents "excess" and the talent shortage coexist at the same time. Although more than 6 million graduates (Fig.1) in each year, but the reality is that a lot of companies cannot find the talent as their need, a lot of graduates cannot find their jobs, and the real employment rate is far lower than the official data provided by 90%. There are many reasons for this phenomenon, but in the final analysis, it is due to that the higher education had been changing from elite education to popular education, however, the college students' comprehensive ability does not meet the requirement as their employ.

### 1.2 New Requirements

Society is changing the requirements to human resource. With the development of science and technology, the enterprise is becoming more and more high requirement to engineering students. Companies no longer simply test our students with highly educated, good scores and other traditional standard for university graduates and replace with comprehensive ability, such as good practical ability, innovation ability, cooperation ability, social ability. Naturally, the first task of higher education is how to satisfy the social demand by professional training. Engineering teaching, therefore, has an important role on the cultivation of the students, and affects students very great in his or her all life.

### 1.3 Reasons of Problems

Almost all of the world have the common problem in higher education. For example, the employment of the overseas returnees is difficult as a clear fact in this point. However, in

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Received: 20, 11, 2013, Accepted: 03, 12, 2013

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abroad due to their education system many difference with China, training mode and teaching mode etc., no such prominent contradiction is presented as in China. The influence of information and technology is becoming more and more intense. In the United States, Japan, and the European developed countries, the innovation education [1-2] has become most one of hot topics in the research of higher education. The Chinese traditional exam-oriented education is the most serious problem of talent training, such as the force-feeding teaching for catching up, experiment lesson short, the weakness in necessary practice; and the less participation and communication between teachers and students, and so on. Teacher's teaching way and method are very simple, the lack of their own special aptitude. In their teaching, it is the most obvious problem that the students' initiative enthusiasm has not been full played. These problems directly conduct severe challenges for our higher education, and it even has become a serious problem that need to be solved significantly. Education quality is the most important thing and critical issue of all higher education. Cultivating what kind of person is the most basic goal of higher education. The innovation in teaching content and teaching mode that must meet the social needs, is an important mean for improving the quality and efficiency of education. The new talent needs must require a new training mode.

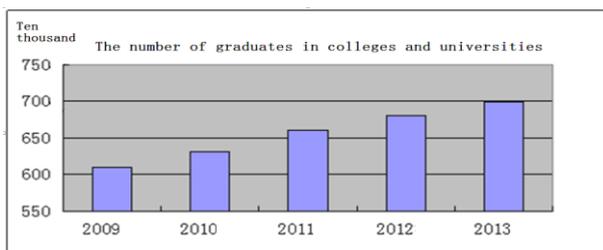


Fig.1 Higher Education Scale of China

## 2. The New Concept of Teaching

In 2011, we began to put forward the "collaborative teaching" on the teaching and "collaborative innovation" on scientific research. Almost all of the traditional teaching mode is that a teacher has a group of students. In fact, a combat-worthy

troops, whatever its size, only an organized collective leadership (it could be a colonel, political commissar, or staff) can led a team that has the cooperation ability and disciplined warriors to effectively complete their fighting capacity. Therefore, under the new education idea, combining with the condition of China higher education and the current problems, the project of Creative Engineering Design Team (CEDT) was proposed a few years ago. The main research of CEDT is study and practice of the new teaching mode. CEDT is different from the Scientific Innovation Team (SIT). But CEDT is how to train the future SIT for enterprise. Though CEDT does not do same as that forces train their fighter, but there are also similarities. CEDT claims the collaborative teaching under the new mode. CEDT tried to cultivate the comprehensive ability of students by mean of a relative complex project.

## 3. Practices in Recent Years

Here we introduce our teaching practice on CEDT in recent years. In the summer of 2011, we proposed the CEDT teaching mode. At present, in the biomedical engineering department of Chongqing Technology University, we have 2011, 2012, and 2013 three groups of master students who receive the CEDT teaching training in a course. CEDT has received the support of college leaders from 2014 year to now, and the college had decided to apply this pattern to the undergraduate engineering students. Through several years of thinking and exploration, the CEDT practice has become a new teaching method to train engineering students, especially for their comprehensive ability, and it is worth the wider exploration and practice in near future.

Here is a brief introduction of CEDT mode, it includes several steps.

Step1: The CEDT team decides what to do. It is an important first step that the collective choice of a comprehensive (simulated) project by CEDT team. At first, the teacher put forward several proposals, students discuss and joint decision between teachers and students. In 2011, for

the biomedical engineering master students, we made a list of projects: “a comprehensive heart sound acquisition system design”, “image acquisition system design”, “flying automatic positioning system design”, “mobile phone glass quality automatic detection system design”, “cell image recognition system design”, etc., most of them are teacher’s completed research projects, only the “flying automatic positioning system design” is not project of teacher, and also it is the most challenging to us. However, students decided to choose the automatic flying project. This project involves a number of technical problems, and students are very interested in it. It includes: aircraft power drive; aircraft attitude and balance control; ultrasonic ranging; GPS; wireless communication; image process and transmission, etc., it had to bring huge workload to teach.

Annotation, before the collective decision to choose the topic, students need to complete the technical analysis of the characteristics and difficulties. The teacher should combine professional and grasp the value of the project according to the student ability condition. The final group discussion between teachers and students is to choose what kind of projects.

Step2: The project decomposition and collaboration. After the determination of a (real or simulated) project, then around the big topic, the CEDT team began to analyze what technology is need to learn, what data need to be check, etc. The full discussion of project is necessary to understand its all of additions. When the task is clear, CEDT members extend to discuss the collaboration. Every student chooses what to do according to their interests and ability, and teachers coordinate their choice. On the management of a project, professor is the chief designer, or task executor, and students serve as the chief engineers.

Step3: Make a work plan. The work plan and schedule discussion is necessary to a CEDT team.

Step4: Report and discuss regularly. In order to keep the seriousness of the CEDT, students should make report and discuss their work and make progress on regular time. Taking

the form of classroom teaching, teachers organize, implement, supervise and control the teaching process and found and solve any problems of students.

Step5: Swaps learning and research content. Each student besides must finish the assigned task, as long as any classmate want to know some aspect content, it is necessary to exchange the contents of each participant in learning and research to improve their teaching efficiency each other. Because each person's power and time are always limited, students can't understand all of aspects of a complex project in a short duration. CEDT emphasizes the team cooperation spirit, each member must be open and generous point of view, every one has a duty to teach other students understand any problem in the CEDT process, such as the problems encountered in the machine or program debugging process, the most difficult problem is how to solve, they should communicate the experiences in success and lessons of failure, and so on.

Step6: Record the whole process of CEDT. Everyone must record the CEDT whole process, including the discussion of various kinds of document, experimental platform, experiment report, pictures or video record of process, and so on. In the end of CEDT, their technology reports should include these relative data and information. Teachers should pay attention to cultivate the students' good work and study habits, pay attention to the education of the work accumulation consciousness. The CEDT members eventually assemble a documentary of all teaching scheme. Practice shows that girls tend to be more adept at documentation filing but not good at technical details, boys are better at the technical details and not good at organization of data archiving.

Step7: Teaching inheritance and integration. In a certain period (such as 3-5 years), the CEDT model can be formed. Previous students have obligations and also necessary to guide the following student's learning process to continue their job. The later should do better basis on previous classmates, which the Japanese give us these experience. The teaching contents, teaching methods, teaching achievements, teaching text

should be archived and inherited down as far as possible, and gradually become a new teaching mode. At the same time, these succession modes can reduce the teacher's workload and improve their work efficiency.

#### **4. Summary and Conclusion**

CEDT also raises many new questions. Project selection and multidisciplinary fusion problem; The course construction and teaching materials construction; The teachers configuration; Education informatization and education resource sharing and so on many problems. The solution of these problems will greatly advance innovation education of the engineering design in universities. CEDT should research the following more questions.

(1) Study on the CEDT teaching purpose and method of choosing projects.

(2) Explore the implementation method of CEDT model.

(3) Determine the CEDT object and teaching conditions

(4) The CEDT need what kind of "cooperative teaching" team.

(5) How to construct and share the CEDT teaching resources .

CEDT is a new kind of teaching mode, it insists the team pattern with "collaborative teaching" and "collaborative innovation". CEDT will produce profound influence on student's comprehensive ability training. CEDT may also strengthen reform the curriculum system.

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