

## Analyzing the Teaching System of Cultivating Innovative Thinking for Mechanical Engineering Students in Colleges and Universities

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*Abstract: The teaching system of cultivating innovative thinking should start from the reform of theoretical and practical curriculums for mechanical engineering with the development of processing technology, in colleges and universities. The purpose of the teaching system reform is cultivating students to use theoretical knowledge to solve the practical problems and create a new product, learning the theoretical knowledge from the practical curriculums. In addition, the teaching system reform which encouraging students to participate in various skill competitions and providing the school-level scientific research projects learning environment to the student who with the engineering background, the reform is very important to improve their ability realizing the teaching system that the theory, practice and innovation are formed an organic whole.*

*Keywords: innovative thinking, teaching system, mechanical engineering, engineer background.*

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### 1. INTRODUCTION

The industrial production system is more and more powerful in china, has made tremendous contributions to the world and enhanced china's economic power index, with the continuous development of the manufacturing technology. The "Made in China" is well known all over the world, making the comprehensive strength of china to the forefront. Former Chinese Premier Wen Jiabao has proposed that China should be transformed from a manufacturing powerhouse into an innovative one at the annual meeting of Davos in the summer of 2011. The national scientific and technological capabilities are not only reflected in the ability to "Manufacturing", but more importantly reflects the ability to "Creating", therefore, the competition of innovative capabilities is the main manifestation of the overall national competitive strength in 21st

century. Innovation is the motive force and source of the development of nation and society, is the core and soul of personnel training. How to realize the transformation from "Made in China" to "Created in China" is embodied in the issue of cultivating creative talents, in the final analysis [1,2].

Colleges and universities are the training base of talents, bearing the important mission of training national innovative talents. Undergraduates are the main force for the development of science and technology and direct impact on the overall strength in future, so the innovative thinking is the most key point of cultivating undergraduates, colleges and universities should focus on training students' abilities of discovering and solving problems [3-7]. To cultivate innovative talents, the reform of theoretical and practical courses is the first step, at present, the teaching of theory courses occupy most of the student's learning time, the practical courses not been unchanged for past many years, the teaching method only emphasis on imparting knowledge, don't pay attention to the development of capacity, this traditional teaching can no longer meet the needs of modern education [8]. Therefore, setting a reasonable teaching system is the most important mission that combining with the major feature for colleges and universities.

The mechanical engineering has the characteristics that the multi-disciplinary cross extent is greater, the combination of theory and practice is larger, the students' innovation requirement is higher, is the most typical engineering majors. In addition, the investment of the aspects of the teaching equipment, teachers, and training ground is relatively more. Consequently, this article will analyze the teaching system of cultivating innovative thinking through the present teaching mode of mechanical engineering in our university. The analysis is surrounding the student, utilize school resources, stimulate the motivation of learning and improve the level of interest and consciousness, provide the reform path for the teaching system reform combining with major feature.

## **2. THE PRESENT STATUS ANALYSIS OF TEACHING SYSTEM (ILLUSTRATED BY THE EXAMPLE OF GUIZHOU MINZU UNIVERSITY)**

At present, the professional teaching content mainly includes theoretical courses, practical courses and social practice, in our university. However, due to the lack of teachers, the insufficient number and type of high-end equipment, the safety training of students is difficult to control, so lead to the teaching content is mainly based on the teaching of theoretical courses, occupying most of the students' learning time. Textbooks are only the teaching content of the students, and the main source of the students' knowledge, the teaching method which injecting and full of irrigation only emphasis on teachers how to teach, don't play attention to students how to learn. The examination mainly relies on rote learning, which is not conducive to the mobilization of students' enthusiasm for learning.

The practical courses play a supplemented role, while some more dangerous training courses and social practical to learn in the form of visiting. For mechanical engineering, practical courses are the most important to cultivating students' innovative thinking, training

students use theoretical knowledge to solve engineering problems. Practical courses include the course exercise of mechanical design, metalworking practical, and professional training courses in GuiZhou MinZu University, there is a common problem that the training subjects are arranged by teachers, and students are only required to complete the tasks according to teachers' requirement, in the practical courses. Such as the course exercise of mechanical design, the training subjects are offered by teacher, which unchanged for past many years, this training method tends to make students more emphasis on training drawing skills, the quality of the drawing is used for the main evaluation index to the student score, although the students' drawing skills are improved to a certain extent, the innovative thinking not be advanced. Resulting to students form a kind of inertia thinking that requires the teacher's guidance and arrangement.

The simplifying and patterned teaching system has neglected developing the student's initiative and the innovation power of thought. The thinking mode is formed under the guidance of such traditional education, but it can no longer meet the needs of students' development and can't make students meet the requirements of new epoch.

### **3. ANALYZING THE TEACHING SYSTEM OF CULTIVATING THINKING**

#### **3.1 Theoretical courses**

Students spend the most time to learn theoretical courses, their thinking mode is influenced by the teaching method of theoretical courses a great extent. Therefore, to improve students' innovative thinking, the reform of theoretical courses is the first step for teaching system reform. Simplifying and patterned teaching method are easily make students lose interest in learning. In addition, there is a connection of course contents among theoretical courses, for examples if students are not interest or understand on one theoretical course, the chain reaction will be occurred in others courses.

Student's interest should be used for the base of carrying out the course teaching, introducing the element as the case of lecture which not only enhance the student interesting but improve the teaching quality in the process of teaching. The Stirling engine is used as an example to illustrate the reform details in the course of Mechanical Design, when the teacher heated the engine cylinder use an alcohol lamp, the piston drives the linkage mechanism to rotate under the action of the pressure difference, all students' attention will be concentrated on the Stirling engine, teacher explain the related knowledge of linkage mechanism by through analyzing the engine rotation process. This method reduces the teacher's teaching burden, increase student understand the knowledge points, but the most importance is stimulate students to think about other related issues.

In addition, students can be grouped to discuss an issue, increasing the interaction between teachers and students, forming the mode of learning from each other. Students can form their own team based on the specifics of the discussed issues, enhancing students' sense of cooperation and improving their social skills.

### **3.2 Practical courses**

Practical courses are the most important part to promote students' innovative thinking, reasonable training mode can strengthen the understanding of theoretical knowledge, form the learning way to study theory from practice.

The course exercise of mechanical design and metalworking practice are the typical common training course for mechanical engineering. The results of the recent years practice teaching shown that the most students are interest in metalworking practice. According to the results, the reason of students are interested is that they can process a product through metalworking practice, and get the accomplishment feeling. The heartfelt wish of students is want to process the product they own design in processing. The heartfelt wish indicating that the method of using processing product as the interest orientation, the orientation solve the problems that the students are short of interests on practical teaching, improve the quality of practice teaching. So, the course exercise of mechanical design can be setting to open training course, and the subject of course exercise is determined by themselves, the design product of the course exercise is used for the processing subject of metalworking practice, students select the processing equipment to machine according to the product's technical requirements.

The purpose of professional training courses is cultivating students use the professional knowledge to solve practical problem, strengthening the understanding of theoretical courses, but the training contents which arranged by teachers limit the development of innovative thinking. Therefore, the teaching system of cultivating innovative thinking requires the introducing of open professional training courses.

### **3.3 Encouraging students to participate in various competitions**

For the students of mechanical design, students have more extra-curricular time, especially into the third grade of college, at present, more and more students spend their extra-curricular time to play games. Colleges and universities should encourage students to participate various competition, and set the appropriate reward system, colleges will provide the proper bonuses and add their Grade Point Average(GPA) for students if their product get better grade, the competition performance can be used for an index to evaluate students' scholarship. This teaching mode not only increases the utilization of students' extra-curricular time, but also improves their interests and arousing potential. Meanwhile, it cultivates the students' awareness of collaborative innovation.

Moreover, the competitions of mechanical engineering also can improve the ability of solving practical problem, this development of ability come from competitions is even greater than the gain from the professional practical courses. For example, the involved content of National College Mechanical Innovation Competition includes all theoretical and practical courses' content of mechanical engineering, requires students to learn the courses' knowledge and solves diverse problems in their extra-curricular time.

### **3.4 Introducing the school-level scientific research projects**

Scientific research projects are another effective way to improve students' innovative ability, create a learning environment with engineering background. Generally, the subject of scientific research project is determined according to students' professional knowledge or interest. Further advance students' capability of collaborative innovation, require students write the project declaration, draft the acceptance criteria, and complete the subject in the form of a team. Students submit their project declaration to the school, school analysis the project feasibility and assess the project cost, provide appropriate funds for students to carry out the project research.

The characteristics of the project are selected by students based on their interest, more effectively stimulate their interest and self-discipline in learning. There is the mutually reinforcing between practices and innovations, students can find out the problems through practice, and seek innovative ways to solve problems. Therefore, colleges and universities should set the special projects that are similar to scientific research projects, to train students' practice innovation abilities, laying a solid foundation for their employment in the future.

## **4. CONCLUSION**

Colleges and universities shoulder the important mission of cultivating national innovative talents. Innovative talents are the main force in social construction and technological development in the future, and an important indicator of the overall strength of a country. The teaching system should be formulated based on cultivating innovative thinking, reforming and perfecting the cultivation system of qualified personnel in time. Through the theoretical and practical curriculum reform, promoting students' ability of using theoretical knowledge in practice, strengthening the understanding of theoretical courses. Encouraging to students participate various competitions, cultivating their awareness of collaborative innovation and enhancing their capacity of solving practical problems. The introduction of school-level scientific research projects forms the teaching system of the combination of theory, practice and innovation.

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