Engineering Mechanics Course Teaching Reform in the Concept of Modern Engineering Education

Ru DONG¹,²,³,a,*, Ya-Ning ZHANG¹,b, Juan DU¹,c

¹School of Architecture and Engineering, Yulin University, Yulin, Shanxi, China
²The City's Water Distribution and Pollution Control Research Center of Yulin University, Yulin, Shaanxi, China
³Shaanxi Key Laboratory of Ecological Restoration in Shabei Mining Area, Yulin, Shanxi China

daongru126@126.com, b394891354@qq.com, 445653055@qq.com

*Corresponding author

Keywords: Modern Engineering Education, Engineering Mechanics, Teaching Reform.

Abstract. The modern engineering education should adapt to the development trend of the global economy in twenty-first Century, put more emphasis on the training of personnel practicality, innovation and openness. In the reform of teaching of "engineering mechanics", we are guided by the modern engineering education concept, reform teaching content, teaching methods, examining ways, strengthen the practice teaching, etc.to develop comprehensive quality engineering talent.

Introduction

Modern engineering such as technical, social, comprehensive and creative as the main characteristics, in addition to meet the needs of science and technology, but also to meet the needs of the community, taking into account the sustainable development of the earth. Dean of Massachusetts Institute of Technology Institute of Technology Professor Brown put forward the "Engineering in Global Economy" concept that modern engineering education should adapt to the development trend of the global economy in twenty-first Century, the characteristics of closely integrated, the subject should have knowledge of the cross and engineering technology and economic activities. [1]

Internationally famous engineering application of modern educational concept of teaching the three other universities are: National Tsinghua University, Paris University of science and technology, Columbia University. Columbia University in the United States suggested that the US engineering professionals have the ability namely: the ability to apply mathematical science engineering; ability to design and conduct experiments, the ability to analyze and interpret data; design a project component or process to meet the needs of capacity; the ability to function in the multidisciplinary team and the ability to solve problems.

"Engineering Mechanics" course is high in theory and practice. It is an important basic course for engineering majors.

Engineering Mechanics contains the content is very extensive, facing education reform in the 21st century process, the creation of engineering mechanics course, not only to cultivate students with a solid foundation of theoretical knowledge, but also to cultivate students' comprehensive quality and creative ability. Therefore, in the teaching content and methods should be further innovation and planning, the absorption of modern education ideas and means for the cultivation of talents to adapt to the new century. [1]

The Characteristics of the Engineering Mechanics Course

Our professor in Engineering undergraduate course teaching of Engineering Mechanics of Analysis of Engineering Statics and material Mechanics, Mechanics of Materials is one of the most basic part.
The theoretical system of the engineering mechanics course is stable, engineering mechanics has its own systematic and logical, in the basic theory of teaching has its specific rules. The goal of teaching reform is to use the modern education thought, let the modeling course includes modeling thought and broad engineering applications into the initiative of teaching, to cultivate the students' creative thinking to provide a higher levels of space.

Reform the Teaching Contents, Methods and Means by Using Modern Engineering Education Theory

"Take the Student as the Main Body, Take the Problem as the Center" Leading Teaching

Problem centered, teaching such as torsion of circular shaft is introduced, the problem of life, the chalk wring section, how to make mechanical analysis? It is to allow students to learn with the problems of life, through the process of solving the problem, training them to use the knowledge of the skills, and ultimately able to make a piece of chalk. Enable students to enter the "fun" learning stage, the initiative to explore the nature of learning, high enthusiasm for learning.

"To Use as a Guide, to Innovation as the Goal" Practical Teaching

At the end of the course, the teacher is still a long-term guidance to students interested in the completion of the subject. For example: college students innovation and entrepreneurship competition, the teacher as a mentor, the student team for the project leader and the participants to complete a project innovation and entrepreneurship practice student choice in the specified time. One of our projects is to test and evaluate the mechanical properties of the materials used in building the laboratory building "$. This project is based on the actual project of the school in which students learn the mechanical properties of low carbon steel by using the experimental course to complete the actual project. In this process, the materials encountered and need to test mechanical properties are increased, students need to learn by analogy, enable students to apply the knowledge and practice what they have learned, stimulate students' practical ability and innovative learning ability. This with the Utah State University professor M. David Merrill proposed the "primary teaching principle" [2] is the same, the "theory with practice, and then ponder new knowledge, learning and be able to use" as a teaching principle, design "activate experienced", "demonstrate knowledge and skills", "apply knowledge and skills", "the integration of knowledge and skills into actual projects."

Stereoscopic Video Teaching for Engineering Components

We've made several screen demonstrates the full force and deformation of engineering mechanics involved, including stretching rod, compression, torsion, bending, shear stress and deformation process or destroyed,

The textbooks plane to force the process space three-dimensional, make it easier for students to understand the point of knowledge, cultivate students' spatial imagination the ability of thinking ability. In this way, to avoid the "explanation" of the dull, boring teaching, students in the classroom atmosphere is very active, active participation, greatly improving the efficiency of teaching. It can reduce the calculation time and writing on the blackboard, so that students will be the main focus for understanding and application, teachers have more time to implement enlightenment and inducement. 3D animation, virtual reality and other means to enable students to understand the content of teaching, fully stimulate students' imagination and creativity, develop students' thinking potential, to create the conditions for the cultivation of innovative quality of students, the effect of achieved using traditional teaching methods cannot achieve.[3]

Reasonable Use of Teaching Aids, Teaching Scenarios

The teacher in the classroom teaching, they can make full use of some kind of demonstration teaching aid or at hand, using visual teaching method can make students like personally on the scene, and it has a great effect to improve the effect of teaching. As for the moment when the axis of the teaching force, we demonstrate by the classroom door, and parallel shaft and shaft intersection...
force can not to make the door rotate. When teaching fails to reverse the problem, pick up a piece of chalk, which was twisted off, the fracture is a typical cross-section of a brittle material, and guide students to analyze the fracture plane orientations.

Information about the mechanics of daily life with examples such as cranes, bridges, building structures, trucks, bicycles and other teaching, so that students feel life is full of mechanical knowledge around common things implicit in the rich mechanical phenomenon and mechanics knowledge, to guide students to observe and analyze the daily life, natural phenomena and engineering problems. Why wheat straw and bamboo grow into a hollow circular cross-section? because the wheat straw and bamboo grown into a hollow circular cross section having an excellent ability and resistance to bending instability; Enable students to see the role of mechanical engineering in practice, to stimulate their interest in learning, to improve their ability to apply the theory to solve practical problems. [3]

Open New Design and Comprehensive Experiment

Experiment is an important link of cultivating students' practical ability and scientific research ability, the content of the traditional engineering mechanics experiment is relatively simple, and most of the verification experiments, we modify the traditional engineering mechanics experiment project selection, merge and supplement, and divided into confirmatory experiment, designing experiment, comprehensive experiment. Strengthening Experimental Thinking and inspiring, and enhance students through experiments discover problems, the ability to research questions will help students experimental skills, in modern engineering concept of guidance, help cultivate students' innovative spirit, cultivate the vitality of high-quality engineering talents for twenty-first Century.

Comprehensive reform of teaching methods, our students have a complete knowledge structure and level of knowledge, training theory, calculation and practice three aspects to enable them to quantitative and qualitative analysis of the problem, analyze the problem with the thought of systems engineering, combined with high technologies, skilled use of computer technology to solve problems. Engineering practice from engineering education, humanities education two aspects, not only focusing on imparting knowledge, but also pay attention to people's culture, so that students learn rigorous engineering way of thinking.

Conclusions

Through the reform of engineering mechanics teaching content, teaching methods, teaching methods, teaching practice and other sectors. These measures of the curriculum so that students have a strong interest, and fully mobilize the enthusiasm and potential of students to form a good style of study. From nearly three years of courses through rate, we found that after the implementation of curriculum reform, the student's pass rate increased significantly, so that it is the most important that students interested in active learning.[4]

Teaching benefits teachers as well as students, teaching reform also contributed to the teacher's teaching, scientific research, scientific research of teachers to enrich the course content, improve the lecture informative and interesting content, and more to promote the teaching.

In the future teaching of engineering mechanics, first requires teachers to have a broad vision, in order to develop the requirements of modern society has a comprehensive high-quality personnel as the goal, to design their own curriculum. Inherited advantages of traditional teaching and cultivating the ability of abstract thinking, coordination of efforts in the combination of traditional teaching methods and multimedia teaching methods, to strengthen the ability of students to establish mathematical and physical models. Teachers should use the concept of modern engineering education teaching, in order to cultivate students' ability to apply the basic knowledge and engineering knowledge, student has the ability to design local and global projects, the ability to create new complex systems with modern technology, the ability to team work, rigorous and thorough way of thinking, and students have a global concept of social development and responsibility.
References


