

Teaching Method Reform of Engineering Mechanics Course for Mechanical Engineering Major in Military Academy

Yuhua Shi^{1, a}, Ning Shan^{1, b}, Pei Feng^{1, c}, Peng Shang^{1, 2, d}, Rongrong Feng^{1, e}

¹ School of Equipment Management and Support, Engineering University of PAP, Xi'an 710078, China;

² School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an 710048, China.

^a359887953@qq.com, ^b

ssnn3193@163.com, ^c83101958@qq.com, ^dsipone@163.com, ^e395391315@qq.com

Abstract. According to the needs of the military development, the present situation of teaching and the factors which affect the quality of teaching of engineering mechanics in our university are analyzed. In order to cultivate applied and innovative technical talents, the teaching method reform of engineering mechanics is put forward from three aspects: content modularity, seminar teaching and learn methods, the basic requirements of engineering mechanics courses facing actual combat talents education were achieved.

Keywords: Engineering mechanics course; teaching methods; teaching reform.

1. Introduction

According to the actual needs of military personnel, military school students are required to not only be able to conduct daily army management, but also to have strong operability and practicality. Therefore, in order for military schools to achieve the goal of transforming to combat and applied talents, it is necessary to reform the traditional teaching content, teaching methods, and teaching ways, and establish a high-quality talent training program that meets the requirements of the military.

Engineering mechanics, as a basic technical course with theoretical, practical and technical features, is a major of mechanical engineering in Military Academy. It is the theoretical basis of many subsequent professional courses. It is in the core position of continuing education in the teaching of mechanical engineering specialty. Both teachers and students attach great importance to this course. The quality of its teaching not only affects the test scores of the students, but also affects the military mechanical engineering-related work that the students are engaged in after graduation. Therefore, to realize the basic requirements of education for talents, the following methods are necessary. Firstly, improving the teaching quality of engineering mechanics and inspiring students' learning interest, Secondly, combining the theoretical knowledge of engineering mechanics with the actual engineering problems of the army, Thirdly, developing students' ability to use the knowledge of engineering mechanics to solve the actual engineering problems of the military.

Engineering mechanics, as an important professional basic course for the mechanical engineering major of the military academy, aims to train students' ability to perform engineering check calculations on equipment components when maintaining and designing equipment. Engineering mechanics includes two parts, theoretical mechanics and material mechanics. Generally, the teaching hours of local colleges are 120-150 hours, but due to the heavy training tasks of military academies and the number of courses that need to be learned, the teaching hour of the course which is carried by our school is 68 hours. Therefore, the content of the course must be reasonably reduced. In order to make the teaching content be useful for subsequent courses or for analyzing practical engineering problems, our school currently determines statics in theoretical mechanics and materials mechanics as the teaching contents. Even so, the amount of class hours is still insufficient. Therefore, what puts relatively high requirements on the teaching ability of teachers is to make it necessary to ensure both the maximum amount of information and the quality of teaching in the teaching process.

The content of engineering mechanics itself is boring and has many formulas. Therefore, it is necessary to change the traditional single method, “teacher speaking, student listening”. Combining multiple methods to maximize the subjective status of students is a good way to achieve a good teaching effect.

2. Content Modularity

Because there are many knowledge points in engineering mechanics, before the course begins, the relationship between the content from beginning to end of the course is first summarized to establish the knowledge map shown in Fig. 1, so that students have a general understanding of what they have learned.

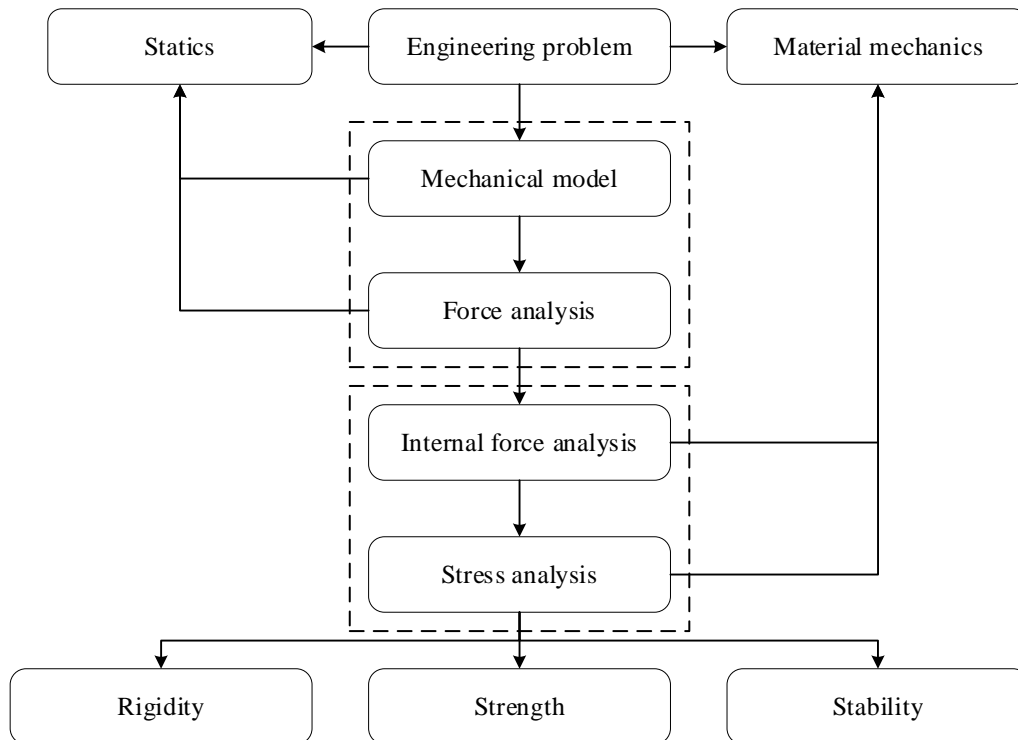


Fig. 1 Content structure of engineering mechanics course in military academy

In the course of teaching, the content of engineering mechanics will be taught in modules. The engineering mechanics offered by our university can be divided into three modules according to the research content. The first module is the statics part, which studies the external forces on the object. The second module is the calculation of the strength and stiffness of the component. The third module is the calculation of the stability of the compression member. The teaching methods of each module are different according to the content. Students can learn in blocks at the beginning of the course, and break through each block. Finally, return to the knowledge map to form a comprehensive knowledge point, establish a knowledge system, and achieve good teaching results.

3. Seminar Teaching

The seminar teaching method includes three parts: question, guidance and discussion. The role of the learner in the learning process is changed from passive situation to active situation, reflecting the subjective status of the student.

For instance, "bending of beams" is the most difficult and important chapter in engineering mechanics. To study this chapter, the students must learn the calculation of the internal force of a bending beam firstly. Because the torsional internal force and the internal force of tension and compression have been studied before, the question can be asked: How many internal forces are there in a curved beam? What are they? Then guide the students to apply the basic method of

internal force calculation—the balance method. Next let the students list the balance equations by themselves. In this process, each balance equation and each item in the balance equation are listed after their own thoughts. Finally, it can be concluded that there are two internal forces of bending beam: shear force and bending moment. At this point, the teachers will guide the students to write the internal forces on different sections of the bending beam under several loads, and require students to discuss What is the relationship between the internal forces of different sections and the external forces on the beam? After discussion and analysis, students can come up with their own calculation methods that directly apply external forces to calculate the internal force of the cross section of the bending beam.

In this way, the students have a stronger sense of participation, so the classroom atmosphere is more active and the learning effect is better.

4. Focus on Guiding Students to Learn Methods

As the saying goes, the mastery of knowledge largely depends on study on one's own, instead of teacher. Therefore, in addition to teaching the course content in the teaching process, it is more important to teach students the learning method of the course.

The first one is the method of analysis. One of the most widely used analysis methods in engineering mechanics is to simplify the complexity. For example, the deformation of a curved beam under various loads can be completely decomposed into the superposition of the deformation of the curved beam under each load, and the combined deformation of a component can also be decomposed into several basic deformations of the component, thus, achieved the goal of simplifying complex problems.

The second one is the method of induction and summarization. Be good at summarizing the learning content, refining the commonness of knowledge points, and cultivating the thinking method of seeking common ground and distinguishing differences. For example, when analyzing the internal stress of deformed members, whether it is tension and compression, torsion or bending, the analysis of stress must be based on geometric, physical, and static relationships.

The last one is the method of solving the problem. For the solution of the problem, it must be clear what the problem is? What is the nature of the problem? What is the solution to this type of problem? For each type of problem, a systematic solution method system is formed. In this way, the students have mastered the correct learning methods, and it is easier to learn, so that their enthusiasm for learning is relatively high.

5. Summary

According to the characteristics of engineering mechanics course in the mechanical engineering specialty of military school, This paper puts forward a teaching method that focuses on the cultivation of students' innovative thinking and the ability to solve practical problems, which changes the traditional “teacher-based” model in traditional teaching, and gives full play to students' subject position in the learning process. Besides, this paper completes the teaching design of engineering mechanics course for practical talents and greatly improves the teaching quality of engineering mechanics. In the future, we will continue to further explore and analyze the needs of troop talents, carry out dynamic updates, and cultivate practical technical personnel who meets the troop needs.

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