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Curriculum Construction and Reform for *Mechanics of Materials* Based on the Training of Outstanding Engineers

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Abstract: The curriculum of *Mechanics of materials* is a professional course for engineering students, which is closely related to engineering practice. Under the background of the current teaching reform, the traditional curriculum teaching mainly focuses on theoretical teaching and ignores engineering practice, which leads to the influence of students' engineering practice ability. Based on the relevant requirements of the excellent engineer program, the teaching reform of the curriculum of *Mechanics of materials* should be accelerated, and the existing problems and deficiencies in the current curriculum construction and reform should be clarified, so as to take targeted measures to improve and promote the students' ability of problem analysis and practical engineering solution. This paper first introduces the background of the outstanding engineer training plan, analyzes the problems existing in the course construction of *Mechanics of materials*, then explores the construction and reform countermeasures for *Mechanics of materials* curriculum based on outstanding engineer training.

Keywords: outstanding engineer, training,*Mechanics of materials*, curriculum construction, reform

Introduction

As for the curriculum of *Mechanics of materials*, the teaching content of this course mainly includes the internal force, stress and deformation problems in the form of tensile and compressive deformation, torsion deformation, bending deformation, combined deformation, etc., and researches on the calculation methods and steps of relevant strength, stiffness and stability. The curriculum of *Mechanics of materials* plays a fundamental role in the cultivation of outstanding engineers in the new era. The theoretical and practical value of the course is relatively high. Therefore, in order to implement the outstanding engineer training plan, we must do a good job in curriculum construction and reform to ensure the continuous improvement of the construction efficiency of the curriculum.

1. Background of outstanding engineer training plan

This program is also known as China's "Outstanding Engineer Education and Training Program". The plan is expected to take ten years to train more than one million high-quality with various types of engineering and technical personnel, in order to build an innovative country, promote the development of industrialization and modernization, as well as give full play to the talents' own advantages[1]. The outstanding engineer training program was initially launched in the first quarter of 2010, and a number of pilot colleges began to implement the plan. As one of the core courses of mechanical specialty in related colleges and universities, *Mechanics of materials* plays an important role in providing effective theoretical and technical support for engineering practice, and also plays a positive role in the follow-up course learning and knowledge

structure improvement of professional students.

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2. Main problems in the curriculum construction for *Mechanics of materials*

According to the current situation of the reform of *Mechanics of materials* curriculum construction, there are still some problems, mainly in the following aspects:

2.1 The current situation of teaching material construction

According to the current situation of teaching material construction for *Mechanics of materials*, the overall content arrangement of relevant textbooks is not practical, nor effectively combined with the actual engineering, because the curriculum focuses on the expression of theoretical content, which lead the application part of practice and conclusion is relatively insufficient[2]. In addition, in the design and arrangement of relevant textbooks, it is mainly for the cultivation of professional engineering ability of relevant talents, but it ignores the training of students' innovation ability and cultivation for accomplishment, which is unfavorable for the cultivation of innovation consciousness and ability of professional talents.

2.2 Teaching focuses on theory and lacks cohesion.

At present, in the teaching of *Mechanics of materials*, the teaching of related courses attaches importance to theoretical knowledge as a whole, and the teaching work on practice part is insufficient. In addition, in the actual course teaching, there are some differences in the cohesion degree of the curriculum teaching carried out by the relevant teachers. The overall curriculum teaching pays more attention to theory, with prominent problems of practical teaching, and the relevant parts of teaching can not effectively transition, which will also affect the teaching effect.

2.3 The teaching method is single and the students' interest is not high.

In the current teaching process of *Mechanics of materials*, the relevant teachers often adopt a single teaching method for teaching. In the long-term course teaching practice, there are few innovative teaching practices and measures. This situation easily leads to students' lack of interest in the relevant teaching content, with low enthusiasm and initiative for overall learning. In teaching, ignoring the students' dominant position and insufficient application of new teaching ideas as well as teaching methods will also lead to the lack of effective motivation in the overall course teaching, with low effectiveness for teaching improvement.

3. Curriculum construction and reform countermeasures for *Mechanics of materials* based on outstanding engineers

3.1 Optimizing the construction of course materials and promoting scientific and rational setting

In the reform of the curriculum construction for *Mechanics of materials*, we should take the reform and optimization of teaching materials as the first step, and optimize the construction of teaching materials from many aspects:

3.1.1 Implementing content arrangement by combining with the practical engineering.

In the excellence program, the course of *Mechanics of materials* should be combined with relevant engineering

practice to reflect practical engineering problems[3]. In the teaching material setting, it is necessary to supplement the theoretical part with specific engineering problems and cases, and set up separate chapters to ensure that the knowledge understanding of the course is more vivid, so as to strengthen the students' ability to analyze and solve engineering problems, as, well as realize the effective training of engineers.

3.1.2 Paying attention to the combination of theory teaching and practice teaching, and strengthen perfection for the conclusion

In the specific reform of *Mechanics of materials* curriculum construction, it should be based on the skill application requirement of cultivation for outstanding engineering. In the application of *Mechanics of materials* and textbook knowledge, we should pay attention to simplifying relevant derivation, combining theory with practice, and explore relevant mechanical models and problems with the help of typical case analysis. We should pay attention to the theoretical guidance in teaching , and strengthen the decomposition process optimization, so as to help students better understand the relevant engineering problems, and be good at summarizing and applying.

3.1.3 Paying attention to the cultivation of students' innovative ability.

Innovative ability and awareness is also the key to the cultivation of outstanding engineers, which is one of the basic qualities necessary for talents in the new era. Therefore, in the course of teaching, we should carry out the training of innovative awareness and ability of professional students to meet the requirements of outstanding engineers' skills and quality, and actively strengthen the teaching practice of relevant parts, so that students can improve the ability to analyze and solve the problems in effectively course teaching.

3.2 Optimizing course teaching and pay attention to teaching practice

In the specific teaching practice of *Mechanics of materials* course, teachers of relevant courses should make clear that the optimization of teaching process and the grasp of order are very important for such specialized and logical courses as material mechanics. Therefore, we should take the practical teaching logic as the guidance for teaching and pay attention to the optimization of the derivation process of problems, for example, With the axial tension compression deformation as the guide, increase the important concepts of internal force, stress, strain, etc., and abstract the general ideas and methods of material mechanics commonly used to study various basic deformation, or organize students to focus on the common problems of structures under various deformation conditions. By optimizing the teaching order, students can better connect the knowledge of relevant parts, so as to achieve the teaching effect of integration[4].

In addition, in order to further strengthen students' knowledge of the curriculum specialty, we can also actively organize students to carry out practical activities, which is also the need to promote students' diversified and personalized development. For example, after learning the relevant knowledge of mechanical mechanics and *Mechanics of materials*, organize students to carry out relevant teaching practice activities, and apply the knowledge of textbook to mechanical design and *Mechanics of materials* experiment, so as to make the knowledge more vivid and solid. Students’ spare time also can be used to carry out mechanical design and *Mechanics of materials* experiments. Mechanical design requires students to master a certain knowledge of mechanical mechanics, and combining with textbooks, give play to the spirit of independent innovation to design relevant mechanical equipment. Students can set their own working environment and preferences for processing and production, and then design the corresponding mechanical equipment. The experiment of *Mechanics of materials* is the re-teaching of the theory learned in the textbook. It is not only make the theory of the textbook become specific but also make students understand the experimental background and experimental principle of the theory.

3.3 Paying attention to the improvement of teaching methods and innovation of the teaching mode

In order to enhance students' interest in the *Mechanics of materials* course, it is necessary to stimulate their

enthusiasm and initiative, and enable students to improve their overall quality in relevant courses,therefore teachers must change the current teaching mode to change the current single course teaching mode into diversified teaching, practice of material mechanics course, give full play to students' initiative in learning, and let them really become the main body of learning and actively learn new ideas and methods to integrate them into the teaching practice of *Mechanics of materials* course, so as to give full play to students' initiative in learning, and make them truly become the main body of learning[5]. In the teaching innovation, we can try to introduce the modern curriculum teaching mode, so that students have the opportunity to continuously strengthen the relevant professional knowledge in learning. With the help of multimedia, information platform and other applications, we can provide rich resource support for teaching and innovate the form and content of the classroom, which is also necessary to improve the teaching effect.

4. Conclusion

Based on the goal of outstanding engineer training plan, it is necessary to strengthen the construction and reform of *Mechanics of materials* course, and recognize the prominent problems existing in the current course teaching, so as to actively take effective measures to promote the continuous improvement of professional teaching quality, and lay a foundation for the cultivation of higher quality outstanding engineers.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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Project

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2. Scientific research project of Wuhan Polytechnic University，Characteristics and dynamic application research of giant magnetostrictive actuator considering hysteresis loss, 2020Y13