

## Discussion on The Bilingual Course Construction of Less Hour Theoretical Mechanics

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**Keywords:** Theoretical mechanics, Less hour, Bilingual, New engineering discipline, Engineering certification

**Abstract:** With the constantly advancing of new engineering discipline and the requirement of engineering certification, the university has put forward a new training plan for the major of mechanical design and manufacturing and automation in 2018. This paper analyzes the key problems to be solved urgently in the theoretical mechanics course in the new scheme, and discusses the teaching outline, teaching method, teaching means, assessment method and selection of bilingual textbook according to the requirements of new engineering discipline and engineering certification.

### 1. Introduction

As China's engineering education officially joined the Washington Agreement, the concepts of student-centered, output-oriented and continuous quality improvement in the engineering education professional certification form a sharp contrast with the traditional subject-oriented and input-oriented education concepts. The transformation of higher education concept promotes the improvement of the quality of higher education. The curriculum and requirements of the mechanical major has also been greatly changed with the continuous advancement of the construction of new engineering discipline. Theoretical mechanics is an important professional basic course of mechanical major. It is a link between past and future courses, demanding higher mathematics foundation, strong logical ability, the ability of analyzing and resolving problems. The content of this course is the basic of follow-up professional courses such as mechanical principle, mechanical design, the basis of elastic mechanics and so on. At the same time, it is conjoined very closely with the engineering practice. How to improve the quality of teaching, strengthen the training of students' scientific thinking and innovative thinking, improve the internal driving force of students' learning, and stimulate students' enthusiasm to analyze and solve problems is a difficult problem to be solved in the course construction of theoretical mechanics.

### 2. The Key Problems to Be Solved Urgently

The mechanical design and manufacturing and automation major (sino-foreign cooperation) of Suzhou university of science and technology's began to recruit students in September 2012, and has 4 classes of students now. 3+1 model was adopted for joint cultivation with the University of South Wales. The students finish the study in china in the first three years and can apply to study in the UK for one year, if students who have passed the IELTS in the last year. In the 2018 training program of Mechanical design, manufacture and automation (sino-foreign cooperative education), the class hours of theoretical mechanics were reduced from 64 to 32, which was arranged in the first semester of the freshman year and conducted by foreign teachers. It is one year earlier than the traditional mechanical class, and more difficulty for the students. To ensure the integrity of theoretical mechanics statics, kinematics and dynamics in short time, it is worth studying how to choose and adjust the knowledge structure system of theoretical mechanics. At present, the key problems to be solved are as follows:

## **2.1 Less Class Hours and More Content**

In traditional theoretical mechanics teaching, the content is usually divided into three relatively independent parts: statics, kinematics and dynamics. They have their own system, each has its own goal, and the content is not closely linked. Therefore the teaching work will inevitably entangle in the tedious theoretical deduction, weaken the interest and practicality of the course.

## **2.2 Poor Cohesion of Courses**

It is necessary to clarify the division between theoretical mechanics and middle school physics and college physics. Instead of simply repeating the content of physics, the core content of theoretical mechanics should be taught on the basis of physics. So, what belongs to the core content of theoretical mechanics must be clear. In the follow-up courses of mechanical major, such as material mechanics, mechanical principles, mechanical design and other courses, what needs to be taught in theoretical mechanics should be clear.

## **2.3 Poor Professional Relevance**

Theoretical mechanics is a professional basic course for engineering majors such as civil engineering, mechanical engineering and environmental engineering. Its content also includes the overall requirements of most engineering majors without considering the differences in majors. Therefore, the corresponding mechanical major should explain statics, kinematics and dynamics related to machine tools and mechanical and electrical products, while for statics analysis such as truss structure which is seldom used by mechanical major students, it only need to be briefly introduced or omitted.

## **2.4 More Difficult to Accept by Bilingual Teaching,**

Students' English level is uneven, but since students are the recipients and beneficiaries of bilingual teaching, their English level and ability to receive bilingual teaching directly affect the effect and purpose of bilingual teaching. How to improve students' foreign language reading and understanding ability, as well as the corresponding listening and speaking ability, is the key to whether bilingual teaching can achieve the training goal.

## **3. Bilingual Teaching Reform of Theoretical Mechanics**

Considering the requirements of engineering certification, combined with the training program of 2018, theoretical mechanics of mechanical design, manufacturing and automation (Sino-foreign cooperation) should be reformed comprehensively in terms of teaching syllabus, teaching methods, teaching contents and assessment methods.

### **3.1 Develop the Teaching Syllabus According to the Requirements of Less Class Hours and the Characteristics of Mechanical Major**

In view of the actual situation of theoretical mechanics time compression, some content can be deleted to save class hours. For example, the concept of the center of the object gravity, the calculation formula of the object gravity center coordinate and other contents are repeated with the advanced mathematics and university physics class. If this part of the contents are still to be introduced in the mechanics class, not only wasted time, but also lack enough attraction for students. For another example, truss structure is very important for students majoring in civil engineering, but it is rarely used by students majoring in mechanical engineering. Therefore, it can be simple introduced to save class hours.

The distribution of class hours in the new syllabus is shown in table 1.

Table 1. The distribution of class hours in the new syllabus.

The Teaching Content		Class Hour	Total
Static Mechanics	Property of force and force analysis of object	2	8
	Simplification and equilibrium of space force system	4	
	Simplification and equilibrium of plane mechanics	2	
kinematics	The motion of the point and the simple motion of the rigid body	4	12
	The compound motion of points	4	
	Plane motion of a rigid body	4	
Dynamics	Particle dynamics	2	12
	Mass dynamics	2	
	Rigid body dynamics	4	
	D 'alembert's principle	4	

### 3.2. Improve the Teaching Effect through Combining Modern Teaching Technology with Traditional Teaching Methods

With the rapid development of computer technology, modern teaching technology has been promoted. Its novelty, diversification and interest can attract students' attention and stimulate their interest in learning. We make materials such as force analysis diagram, motion analysis, formula, theorem, sample and engineering example into multimedia courseware including text, sound, images, animation, video. It can save class hours and present the course content to students more visually.

Mechanical design manufacturing and automation (sino-foreign cooperation) is run in small classes with the most advanced multimedia equipment, which adopted the touch screen computer projector instead of the traditional shadow cloth type. Also screen can sync shots which is easier to implement interactive teaching.

### 3.3. Selection of Appropriate Bilingual Textbook

Theoretical mechanics is one of the difficult courses to learn in college, moreover the bilingual teaching of theoretical mechanics is even more difficult. It requires not only a very good foundation of mathematics, but also a very good foundation of English. In addition to mastering the knowledge of non-linguistic subjects, professional knowledge should be taught in foreign languages, so as to further improve the level of foreign languages. That is what bilingual teaching emphasizes.

The process of bilingual teaching includes using English textbooks, cross-using english-chinese bilingual teaching, blackboard writing in English, assigning homework in English, and setting exams in English. Generally basic mechanics course in our country is divided into two parts of theoretical mechanics and material mechanics according to the research object (rigid and deformable body). However, in Europe it can be divided into two parts of statics and dynamics according to the motion state. So much of the contents of statics and dynamics in original textbooks are equivalent to the contents of the theoretical mechanics course, but not completely. Of course, the statics section also includes the contents of materials mechanics.

At present, foreign teachers' teaching notes and courseware are adopted as teaching materials, which are sorted out by referring to several textbooks, including the key content of this course, but lack of systematicness and integrity. Therefore, we compared several textbooks and selected the appropriate reference materials for students.

### 3.4. Reform the Assessment Method

Theoretical mechanics is a basic technical course with the nature of both basic theory and applied technology. It requires students not only to master the basic theory of the course, but also to learn how to deal with the mechanical problems in engineering and the ability to abstract practical problems into mechanical models. At the same time, with the rapid development of modern computer technology, students are also required to master the ability to solve simple engineering problems in analysis, calculation and experimental research using computers. Therefore, from the

guiding ideology, the examination of theoretical mechanics must realize the transformation from traditional knowledge assessment to balance between knowledge assessment and ability assessment.

According to the original assessment method, students' scores are composed of regular scores and final scores, accounting for 3:7. In this assessment method, The final examination proportion is too large and the assessment method is single which is not conducive to students to master and flexibly use of the basic knowledge of theoretical mechanics. We propose the more feasible assessment method which takes the application of major projects, small papers, experiments, usual operations, the examination of these ways of comprehensive assessment.

Students' final scores are made up of assignments, papers and final exams, with assignments and papers accounting for 30% each and final exam scores accounting for 40%. The scores of students in mechanical design, manufacturing and automation of the class of 2018 are distributed as follows: one student with a score above 90, eight students with a score of 80-90, twelve students with a score of 70-80, ten students with a score of 60-70 and seven students with a score below 60. The failure rate is 10% lower than the original assessment method.

#### **4. Conclusion**

After the teaching reform, the learning time ratio of theoretical mechanics class and class reached 1:3, which improved students' independent learning ability, paid more attention to cultivating students' problem-solving ability, and strengthened the training of engineering thinking. Through the practice of theoretical mechanics course in the fall semester of 2018, students' learning enthusiasm for the course has been significantly improved, their ability to solve engineering problems has been improved, their understanding of mechanical major has been strengthened, their ability to write academic papers has been improved, and their academic quality has been improved.

#### **Acknowledgement**

This paper was supported by the comprehensive curriculum reform project of Suzhou University of Science and Technology in 2018 (Grant NO. 2018KJZC-56) and the teaching reform and research project of "undergraduate teaching engineering" of Suzhou University of Science and Technology in 2017 (Grant NO.2017JGY-17).

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