The Reform and Practice of "Advanced Mathematics" Course for the Civil Engineering Majors

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Abstract. The paper analyzes the role of advanced mathematics for civil engineering students to learn professional course, and analyzes the advanced mathematics teaching of our school overseas students facing the pressing problem. Combined with the need of professional courses related to civil engineering, advanced mathematics teaching content of foreign students are discussed. From the different inner needs and personality characteristics of overseas students, the discussion of advanced mathematics teaching mode and teaching method is made. Break the traditional teaching framework of advanced mathematics, the problem of students be weary of learning advanced mathematics is solved. Research results have the general reference value to basic course teaching of overseas students of other major of science and technology.

Introduction

Advanced mathematics as an important public basic course of civil engineering students. The effect of the course to the study of the follow-up professional courses and student's long-term development has a far-reaching influence, and inevitably influence the cultivation of qualified engineering talents. For students majoring in civil engineering, mathematics is the basis of professional course, and specialized tools. It provides the necessary quantity analysis method and calculation method for the follow-up professional course study. And the traditional teaching model of higher mathematics, in order not to affect the rigor of mathematics knowledge, most of the teachers is to impart pure mathematics knowledge. This cannot let students understand its close link between higher mathematics and civil engineering studies, more can't dig up higher mathematics knowledge application in the civil engineering. Therefore it not well stimulate students interest in learning, did not obtain satisfactory teaching effect.

Our school is the most international university, besides from mainland China, from overseas Chinese, Chinese outside mainland China, Hong Kong and Macao, Taiwan, the number of students is more than other school, have more than 10000 people, the country's first. The objective conditions determined, the basis of overseas students have a certain gap compared with the students from mainland. For the vast majority of overseas students, higher mathematics is a course that often make them feel very difficult to learn. Many overseas students take higher mathematics as an invisible burden, because their elementary mathematics foundation is generally poor, the elementary mathematics quality of these overseas students could not reach the requirements of learning higher mathematics. The higher mathematics is an important public basic course institutions of higher learning, a required course, especially to civil engineering of our school. To do a good job in civil engineering major of overseas student’s higher mathematics teaching work is great difficulty.

As an engaged in the enrollment of higher mathematics teaching in civil engineering professional teachers for years, I deeply realized the teaching method to overseas student lagging behind, it cannot adapt to the needs of the situation, the teaching hours using is unreasonable, textbooks applied is insufficient and so on. Thus it caused the teaching status quo of overseas students is not optimistic. In this paper, starting from the characteristics of overseas students, higher mathematics teaching method and teaching model of overseas students of civil engineering specialty are discussed necessarily. Research results have the general reference value to basic course teaching of overseas students of other major of science and technology.
Teaching Innovations

In view of the overseas students elementary mathematics foundation is weak. Poor planning and self-control ability, classroom discipline loose, used to practical application classes, to the mainland teaching concept, methods and means are not able to accept and so on, the paper puts forward the following teaching mode, teaching method and teaching content reform measures.

1. According to the training scheme of civil engineering undergraduate overseas students, revised syllabus, integration of teaching materials. According to the civil engineering professional features flexible teaching content, to achieve the organic combination of the higher mathematics, the related courses, and related content. Professional basic course, professional backbone course, professional direction course is demand for higher mathematics courses as follows table 1.

<table>
<thead>
<tr>
<th>Course Name</th>
<th>The main required higher mathematics knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theoretical Mechanics</strong></td>
<td>Higher derivative, Partial derivative, Definite integral, Surface integral, Curve integral, Double integral</td>
</tr>
<tr>
<td><strong>Materials Mechanics</strong></td>
<td>Definite integral, Indefinite integral, Definite integral constant coefficients of higher order homogeneous linear differential equations, Higher order derivative calculation, Curvilinear integral, Surface integral</td>
</tr>
<tr>
<td><strong>Structural Mechanics</strong></td>
<td>Definite integral, Differential, Curvilinear integral, Multiple integral</td>
</tr>
<tr>
<td><strong>Elastic Mechanics</strong></td>
<td>Partial differential equation, Curvilinear integral, Surface integral, Double integral, Higher order derivative calculation</td>
</tr>
<tr>
<td><strong>Hydromechanics</strong></td>
<td>Differential equations, Indefinite integral, Definite integral, Double integral, Surface integral, High order partial derivative, Derivative, Regional endless abnormal points</td>
</tr>
<tr>
<td><strong>Civil Engineering Surveying</strong></td>
<td>Limit and endless improper integral, Definite integral, Regional endless abnormal points</td>
</tr>
<tr>
<td><strong>Basic Principle of Concrete and Masonry Structure</strong></td>
<td>Unary integral, Higher derivative calculation</td>
</tr>
<tr>
<td><strong>Soil Mechanics and Foundation</strong></td>
<td>Unary integral, Partial derivative and integral calculation, Regional endless abnormal points</td>
</tr>
<tr>
<td><strong>Steel Structure</strong></td>
<td>Differential equation</td>
</tr>
<tr>
<td><strong>Building Structure Seismic</strong></td>
<td>Differential equation</td>
</tr>
<tr>
<td><strong>Multi-storey Building</strong></td>
<td>Derivative calculation, Unary integral, double integral calculation, Higher order linear differential equation with constant coefficients</td>
</tr>
</tbody>
</table>

2. Overseas students and mainland students using dividing teaching method. From class 2012, majoring in civil engineering has carried out dividing teaching. In view of the difference between Overseas students and mainland students. Divided to different classes for teaching, teaching schedule, plan, the difficulty, emphasis and styles are adjusted according to the concrete situation. From higher mathematics perspective, mainland students use more abstract quantitative teaching mode, to do each theorem is derived and the understanding of the demand is higher, and be proficient in the relevant example calculation. Overseas students take concrete standard teaching mode, the demand theory is low, focused on the understanding and application of specific formula. Practice has proved that this mode effect is better.

3. Classroom teaching method

(1) Attach the importance role of higher mathematics history to teaching, combine classroom teaching content, properly introduce about mathematics history knowledge, increase the higher mathematics teaching ideology, interesting and scientific.

(2) Blackboard writing is given priority to Media assisted teaching method. Higher mathematics classroom teaching should break the previous way of teaching a blackboard and a piece of chalk. Blackboard writing on deriving the mathematical formula and demonstrating problem solving and application plays an important, PPT presentation is irreplaceable. But appropriate uses the multimedia teaching can achieve twice the result with half the effort. The organic combination of...
blackboard writing teaching and multimedia can make higher mathematics teaching effect to be better.

(3) Students participation in the classroom discussion method. Overseas students active thinking, the characteristic causes its discipline is poorer, but also can be directed at the same time to improve the teaching effect.

Through different questions and exercises in class, stimulate students to think about math problems to enhance consciousness of innovation, and it is the understanding and sublimation of the spoken content. To strengthen overseas students mastery of logical and systematic learning content, can effectively make overseas students from passive to active learning.

(4) Strengthen the communication and interaction between teachers and students. Fully communication with students, let students feel the teacher approachable and caring, through in-class and extracurricular communication, it causes the student be parent to teacher, believe to its faith, improve the learning interest.

(5) Combining with the major to choose teaching content. Combining with the characteristics of civil engineering major to adjust teaching content. Cut the content such as "uniform continuity" and "uniform convergence" that is seldom used and troublesome, make it meet the needs of the subsequent specialized courses, to lay a solid foundation of theory and practice for study of subsequent professional course. Join some examples related to profession, the greatest degree of improving the students' learning enthusiasm. For example, the introduction of indefinite integral can use specialized courses to attract attention, in architectural mechanics course, often see contains symbols and formula of indefinite integral calculation is needed. Such as in solving the deformation of the bar displacement, stress and strain relationship and stress calculation formula can be written as the rate of axial displacement change along the stem axis \( \frac{du}{dx} = \frac{F_N}{E_A} \), it shows the degree of deformation axial tensile, compression bar, requires axial displacement \( u \), it is \( \frac{F_N}{E_A} \) original function, mean to solve \( \int \frac{F_N}{E_A} dx \), formerly it is to solve the derivative of a function, now know the derivative of a function for this function, this is the problem of solving this function integral, which introduce the concept of indefinite integral.

(6) In the process of teaching, language easy to understand.

For example: the partial derivative of multivariate function is equivalent to what kind of unary function derivation. The chain rule of multivariate composite function derivation: firstly draw variable diagram, reoccupy 16 word mantra: "section with multiplication, split with plus, single way full derivation, fork road partial derivatives" to derivate. To overcome the students' fear of higher mathematics, students are easier to accept and understand.

(7) The introduction of mathematical modeling teaching methods. The traditional teaching activities carry on "definition - theorem - inference - sample" mode, the students feel boring, feel at a loss, can't to recognize the knowledge background, come across new problems don't know how to use mathematics knowledge and methods to analyze and solve. Put forward "case manually start - task driven - test drive – students operation" classroom teaching mode, introduce mathematics model teaching, through the introduction of the actual problem, tell the students how to seize the main contradiction, conclusion will be accurate and concise, this is the actual problem to be mathematical process.

(8) For basic knowledge and basic principle, through the examples, reflection question, exercises, the mid-term test, reviewing exercises, repeated explain. The final arrangements 2-4 times lesson on reviewing exercises, lead students review the teaching material content.

Students' evaluation in higher mathematics is getting better and better, the final course assessment in 2015 higher mathematics I and higher mathematics II all up to top 15 (10%) in college of science and technology.
Conclusion

This article from the perspective of civil engineering professional teachers, and combine the teaching experience in past few years I have engaged in higher mathematics of overseas students, according to the characteristics of civil engineering overseas students to build higher mathematics teaching reform measures. According to the present, Jinan University majoring in civil engineering overseas students problems in higher mathematics teaching, put forward the solution. Combined with the need of professional courses related to civil engineering, overseas students learning of higher mathematics teaching content are discussed. From the different inner needs and personality characteristics of overseas students, teaching methods and teaching pattern of higher mathematics are discussed. To improve the teaching quality and realize the enrollment of higher mathematics teaching in civil engineering optimization. In this paper, the study has general reference value to other professional polytechnic school overseas students of mathematics teachers' teaching, at the same time to the other school higher mathematics teaching, and to other basic course teaching reform can also play the role of throwing a sprat.

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References