Research of Numerical Methods for Engineering Course with New Engineering Feature

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Abstract. This paper focuses on the course teaching system reform for numerical methods for engineering with new engineering feature. The course of numerical methods for engineering has strong theoretical knowledge, complicated experiments and calculation, which is difficult to active the students’ attention. Thus the existing curriculum system should be reformed. Take the course of numerical methods for engineering in Light industrial mechanics department for example. Firstly, based on the teaching idea, strengthen the process of the students in school education. Introduce interaction between students and teachers; promote initiative of students, continuous improvement to achieve leapfrogging. Secondly, improve the teaching methods and means. Breaks the traditional teaching mode and emphasizes students’ participation consciousness. Put the students in the central position of classroom teaching and fundamentally change the students’ class status. Then, design the teaching content, the course can be divided into several modules to give lectures and arrange discussion between students and teachers. Fourthly, modularize method and continuous improvement is applied in our teaching thoroughly, and guide the students to participate in teaching processing actively. Finally, establish a perfect assessment way, sum up experience timely, and constantly revise and improve our reform. With these, a good start can be made for the reform for numerical methods for engineering in new engineering education.

Introduction

To improve the new subject specialty and transform the existing specialty, train the new engineering technicians to meet the needs of the industry and new economic situation, the new idea, new mode, new method, new content and new quality of engineering education are taken as the basic contents of the new subject construction and education reform of colleges and universities. In the training for new engineering technicians, more advanced knowledge, such as natural science, mathematics, engineering science, humanities and social sciences, specialties, disciplines and comprehensive ability which includes the application of the knowledge learned to solve practical engineering problems, engineering design, innovation and creation are needed to be mastered [1].

Zhengzhou University of Light Industry, in Zhengzhou city of Henan province, which is the national ministry of education pilot college education (outstanding engineers training plan) and is also only for light industry, food, electrical appliances, industrial design undergraduate course colleges and universities. Among them, light industry design is a professional institute of Zhengzhou University of Light Industry characteristics. In recent years, this university has provided high quality
service for enterprise, collaborated with enterprise and promoted in production-study-research cooperation education. This university has taken students-oriented concept and concept of study for the purpose of application as an important thinking, and employs high-quality curriculum system, reverse course and network curriculum, which has a good effect in students' education [2-5].

**Characteristics of Numerical Methods for Engineering**

The course of numerical methods for engineering is an important professional basic course in light industrial mechanics department for the school of mechanical and electrical Engineering, Zhengzhou University of Light Industry, which is also necessary for subsequent courses, such as mechanism design, mechanical optimization design and graduation design. In this course, 32 class hours are arranged, which includes 24 teaching hours and 8 experiment class hours.

The characteristics of numerical methods for engineering are as follows. The contents cover widely and the knowledge is updating fast. Also this course has strong theoretical knowledge which is basic but foremost. Moreover, the numerical experiments are complicated. Large amount of homework and complicated calculation are also needed.

In the new engineering feature, how to carry out the reform of the numerical methods for engineering curriculum, in order to better support the training requirements of students' humanistic literacy, psychological quality, communication ability, practical ability, independent learning, innovation ability and team cooperation consciousness is an important part of the cultivation of college students' forward-looking original innovation ability. However, the reform and research of numerical methods curriculum system, teaching content and teaching methods are far from adapting to the rapid development of engineering education.

**The Research of Our Teaching Team**

Firstly, put forward the teaching idea. The ideas of our course are as follows. Student-based, strengthen the process of the students in school education. Introduce interaction between students and teachers, promote initiative of students, continuous improvement to achieve leapfrogging. The teaching aims of this course are as follows. (1) Master the basic methods, steps and some common engineering mathematical models of engineering mathematical modeling. (2) To master some basic numerical methods for solving mathematical models, including interpolation method, numerical integration, iteration method for solving equations, root of equations and numerical methods for solving ordinary differential equations. (3) Correct understanding of engineering mathematical modeling methods, such as interpolation and fitting methods, approximation algorithm, can be correctly selected and designed in specific design. (4) Be able to master and use numerical optimization method to analyze and improve practical engineering problems. (5) Preliminary ability to solve simple engineering problems with numerical optimization algorithm. These aims are related to the three graduation requirements which are as follows. (1) Master natural science knowledge such as mathematics, physics and chemistry, and use it to calculate, solve and establish abstract models for complex mechanical engineering problems. (2) Recognize that there are many options to solve complex mechanical engineering problems, and obtain reasonable solutions through literature research. (3) Develop technical tools for solving, simulating and predicting complex engineering problems.

Secondly, improve the teaching methods and means. Breaks the traditional teaching mode and emphasizes students' participation consciousness. Put the students in the central position of classroom teaching and fundamentally change the students' class status. Makes the students' status from a passive knowledge recipient to one active knowledge explorer. In order to attain our goal, combine the teaching method(Intensive lecture, discussion, reverse course and practice). The teachers grasp the important and difficult points, and focus on engineering background and practical case analysis. Through discussion between teachers and students, keep guidance of our method, help students grasp
the learning methods and management. Promote professional cognitive function and professional and knowledge interest, which can help the students' professional and professional development. Through the discussion, the communications between the students and the teachers can be promoted. It can also help teachers and students change positions, which can establish and build up new relations between the students and the teachers. Through students' own organization to search for information and conduct discussions, state their views, conduct in-depth discussions in the classroom, and strengthen learning student-led teaching method. In this teaching method, students can not only improve their ability to discover, analyze and solve problems, but also improve their comprehensive quality through discussion and cooperation.

Then, design the teaching content. According to the knowledge structure system and content characteristics of numerical methods for engineering, the course can be divided into several modules to give lectures and arrange discussion topics. There are both classical contents and new problems, involving multiple fields and interdisciplinary disciplines, strive to achieve a wide range of background with depth. Six sections are applied in our teaching, which includes: mathematical model in engineering and the introductions of numerical methods, interpolation and fitting methods, numerical integration and differentiation methods, numerical methods for systems of linear equations, solution of non-linear equation, and numerical optimization method and engineering application. In the teaching process, basic principles and thoughts are the key points in numerical method in engineering. Computation and numerical experiments are also the key and the difficult points.

The fourth one is the implementation of our reform. Modularize method and continuous improvement are applied in our teaching thoroughly. According to the teaching aims, the six sections of teaching designs are made through intensive lectures, discussion and exploration, and basic experiments. Guide the students to participate in teaching processing actively. Make students show their own learning outcomes, improve and modify their methods. According to students' feedback, supervision and evaluation to evaluate the teaching effect, and module design and implementation process is modified and perfected.

Finally, establish a perfect assessment way. We should pay more attention to the process, which consists of four forms, classroom assessment, experimental training, homework and final examination. In our teaching, classroom assessment and homework have 30% of the total score, experimental training has 20% of the total score and final examination has 50% of the total score. This course evaluation way, can reflect the teaching training aims and graduation requirements. The degree of this course can be computed. According to the degree, sum up experience timely, and constantly revised and improved new our reform.

Summary

In our view, the teachers should not only have deep professional knowledge and practice ability, but also have advanced educational concepts with new engineering feature, such as student-oriented, output oriented. Thus they can scientifically design the teaching process according to the curriculum characteristics and educational rules, to gradually improve teaching and learning methods and teaching quality. This puts forward higher requirements for the teaching and learning of university courses. Through the overall arrangement of teaching content, discussion topics between students and teachers, which will lead to a good circulation as follows: problem and theory-teacher teaching and students learning-discussion between teacher and students- experimental practice-further teaching, learning and discussion- problem solving. This is a good start for new engineering education.

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References


