

# *Teaching Reform and Practice on Course of Numerical Computation Method in Applied Technology Undergraduate Institutes*

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**Abstract**—In this paper, the reform of the teaching mode of the course "Numerical Computation Method" was explored and practiced in the application-oriented undergraduate colleges and universities. Based on the social demand for applied innovative talents with scientific and engineering computing abilities, this paper firstly analyzed the current teaching situation of this course and its important role in cultivating innovative talents. Then, it put forward some suggestions and measures for teaching reform from the aspects of examination modes, teaching methods, teaching contents and teaching means. Finally, the teaching effect of this course was shown to support the reform measures.

**Keywords**—talents training; numerical computation method; innovative ability; teaching reform

## I. INTRODUCTION

As a key construction university in Fujian Province, building a pro-industrial high-level applied technology university has always been the goal of Xiamen Institute of Technology. In recent years, the school actively explored the innovation and entrepreneurship research as one of the talent training model, and established the first innovation and entrepreneurship park in Fujian Province. At the same time, in order to speed up the implementation of innovation-driven development strategy and promote the comprehensive reform of higher education in our university, it has set up a leading group to deepen the reform of innovation and entrepreneurship education in Xiamen Institute of Technology.

With the continuous advancement of the school's innovative and entrepreneurial policies, in recent years, the school has achieved fruitful results in the training of innovative talents. Especially in the third China "Internet +" college students innovation and entrepreneurship national finals, the students who came from Xiamen University of Technology won one gold, one silver and two bronze outstanding results. As we all know, the analysis of all kinds of complex engineering problems often include complex numerical calculation, and the numerical computation method is an applied course which combines mathematics and computer technology closely. It has a wide range of applications in water conservancy, machinery, aerospace and other fields. At Xiamen University of Technology, the audience of this course is wide. It is aimed not only at undergraduates in the School of

Applied Mathematics, but also at undergraduates majoring in full-time engineering, graduate students majoring in electrical engineering and vehicle engineering. Therefore, how to implement the curriculum reform based on innovative talent training model, and further improve the quality of personnel training, is a problem worthy of consideration.

In recent years, many investigations related to the training model for the innovative talents in application-oriented undergraduate colleges and universities have been carried out. In paper [1], the whole-process training ways to cultivate the comprehensive quality of applied talents were studied, including the transformation of education philosophy, the optimization of curriculum system, etc. In paper [2], the authors analyzed the training model of the innovative talents at MIT and put forward that four innovative dimensions should be developed in the process of cultivating innovative talents in colleges and universities in China. Feng et al. [3] probed into the all-round training mode of innovative talents in biotechnology specialty from the aspects of three platforms, five measures, four projects and so on. In addition, the positive effect of mathematical contest in modeling on the cultivation of innovative talents have been discussed in reference [4,5]. Su and Sui [6] discussed the development process of scientific and technological innovation and personnel training in colleges and universities in the past 40 years of reform and opening up in China, and founded that the colleges and universities had played a more and more important role in the national innovation system. Zhang [7] investigated the present situation of the cultivation of innovative talents of international trade specialty in higher vocational education under the new situation and put forward some new training strategies.

However, there are few articles discussing the ideas and strategies of innovative personnel training in the course of numerical computation method. In this paper, we discuss the importance of this course in the cultivation of innovative talents from the aspects of examination methods, teaching methods, teaching contents and teaching means. The practice shows that the course of numerical computation method has achieved significant results in the cultivation of innovative talents.

## II. THE SIGNIFICANCE OF NUMERICAL COMPUTATION METHOD IN CULTIVATING INNOVATIVE TALENTS

Numerical computation method is an applied course to discuss how to use computer to solve various mathematical problems encountered in science and engineering. It has become an important means for human beings to carry out large-scale engineering calculation. Therefore, studying and mastering the relevant theories of this course can provide basic theoretical support for students to use computer for scientific calculation and engineering calculation. The task is to simplify and solve many difficult mathematical problems by numerical algorithm, and to obtain approximate solutions to meet the error requirements. As an "pro-industry" application-oriented undergraduate university, how to formulate the corresponding personnel training model around the industrial orientation and industrial value is a problem that the school has been exploring in the recent stage. As an applied course, numerical computation method has been playing a key role in solving related complex engineering problems. Therefore, It makes sense to offer numerical computation method courses in undergraduate and postgraduate stages. It can not only improve students' practical ability, but also improve their innovative ability.

## III. THE REFORM AND EXPLORATION OF TEACHING MODE OF NUMERICAL COMPUTATION METHOD

In order to form the talent training mode in accordance with the characteristics of Xiamen University of Technology by reforming and innovating the teaching mode of this course. The course team actively carries out the reform of teaching methods, teaching contents and teaching methods with the reform of examination as the starting point.

### A. Examination Reform

In the curriculum assessment content and assessment methods, we try to transfer the assessment content and evaluation criteria which is used to focus on the knowledge memory to the practical ability of students, so that students can apply theoretical knowledge to practical engineering problems. Therefore, in the evaluation of curriculum results, we use the following criteria: curriculum results = 20% (homework, experiments) + 50% (project report) + 30% (final results).

### B. Reform of Teaching Methods

Innovative education is the consensus of the current society, and the appropriate teaching methods play a vital role in completing the teaching content, mobilizing students' initiative and enthusiasm in learning and inspiring their innovative thinking. In order to fully combine innovative education with classroom teaching, experimental teaching and social practice, teachers in this major have actively explored the reform of teaching methods. They try to apply the project teaching method, the experimental teaching method, the flipping classroom and other teaching modes to the class.

As a supplement to classroom teaching, practical teaching plays a positive role in cultivating students' innovative ability.

Therefore, in order to enable students to transform their theoretical knowledge into practical ability and trigger their innovative consciousness and creative ability, this course will have a week of curriculum design at the end of the theoretical and experimental courses. This is a course that is closely integrated with computers. the task of this course is to provide accurate algorithms for practical problems and solve the problem in a week.

At the same time, in order to make our students become applied innovative talents with strong practical ability and communication ability. Based on the orientation of Xiamen University of Technology "Building Haixi first-class and pro-industrial university", This course actively explores the classroom teaching mode based on innovative projects, and integrates the learning objectives of the project into the students' classroom teaching. The combination of theoretical knowledge and practice makes students master the relevant theoretical knowledge in practice. The students' learning content and the main line of the project are combined through the construction of innovative project training plan. Meanwhile, students are arranged to complete a sub-project every month, so as to achieve uninterrupted project learning.

### C. Reform of Teaching Content

In the design of teaching content, we should strive to realize the combination of theory and practice, taking into account that the teaching content should meet the requirements of the subject and the knowledge structure of the students. At the same time, the teachers of the research group need to follow the syllabus and teaching plan of this course. Distribute the teaching content evenly among the projects. Therefore, teachers need to consider whether the content of the project is closely integrated with the student's major before class. For example, when teaching the course to undergraduates and graduate students majoring in mechanics, the project we arrange will take the related problems in the engineering fields such as machinery and aerospace, so that the students can combine the learning content with the main line of the project.

In the construction of curriculum resources, we provide various forms of learning materials on the internet according to the professional differences of students and the differences of learning basis. Such as video courses, discussion topics for each chapter, test questions and related extracurricular reference materials. Meanwhile, we also provide some resources that have a certain expansion in depth and breadth, such as adding some small projects in the fields of machinery, aerospace and so on, so that students can understand the knowledge points and skills in the process of completing the project.

### D. Reform of Teaching Methods

In big data era, information and computer technology are more and more widely used in daily life, work and production, which requires students not only to have a good theoretical knowledge structure, but also to have a certain practical ability. Therefore, in the teaching process, we have been committed to the combination of classroom teaching and computer practice, project development and curriculum design.

In 2017, this course was rated as online excellent course of Fujian Provincial. We will make full use of this opportunity to vigorously promote the mixed teaching model. The students will be required to submit experimental reports, study reports, classroom assignments, and so on in the Huike internet platform. The combination of online teaching and classroom teaching is realized which improves the teaching effect.

At the same time, in order to meet the needs of economic and social development, we hope to improve the professional skills of our team through social practice, and build a team of high-quality teachers with strong innovative ability. Therefore, In order to improve their practical ability and innovative ability, the teachers of our team have actively carried out school-enterprise cooperation with relevant enterprises in recent years on the premise of not affecting the normal teaching work.

#### IV. CONCLUSIONS

Exploring the teaching reform and practice of numerical computation method based on the training mode of innovative talents is the implementation of the 13th five-year plan of Xiamen University of Technology, and at the same time, it also provides mathematical support for the cultivation of applied innovative talents in other majors. Our teaching team has actively explored the innovative teaching idea in view of the disadvantages of the traditional teaching mode of numerical computation method. Some attempts have been made from the aspects of examination method, teaching content and teaching means, and some achievements have been made:

1. The course of numerical computation method was evaluated on the provincial online excellent course of Fujian Province in 2017. This year, more than 900 undergraduates and graduate students have taken the online course at Xiamen University of Technology and Xiamen Huaxia University. we strive to open courses for undergraduates and graduate students in colleges and universities throughout the province in the next two years, and the number of elective students can reach about 2000.

2. As we all know, the numerical computation method plays a positive role in solving nonlinear problems in computational intelligence. Therefore, it can help students majoring in mathematics improve their ability to analyze and solve practical problems. Meanwhile, it is helpful for them to do some work related to artificial intelligence in the future. For non-mathematics majors, this course is also beneficial for them to understand the application of mathematics in engineering and improve their innovative practice ability.

3. The classroom teaching mode based on innovative projects will enable students to understand and master how to apply the theoretical knowledge to the specific practical problems. In this process, students not only understand the application of mathematics in engineering practice, but also enhance their enthusiasm and initiative in learning by analyzing and solving problems. Therefore, the students' ability to solve problems, self-learning ability, innovation ability and team spirit have been cultivated through the teaching reform of this course. The most important thing is that the teaching idea of creating an application-oriented university is realized through the practical process of the project teaching of this course. Meanwhile, It provides experiences for the reform of the teaching mode of other courses.

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