

Research and Practice of Building Innovative Talent Training Mode in Higher Vocational Education Based on Mathematical Modeling

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ABSTRACT

Mathematical modeling is a bridge between mathematics and application. Based on mathematical modeling competition, modularization of teaching content and project teaching, this work first carried out teaching reform and exploration practice of higher mathematics course in higher vocational colleges, then constructed the mode of cultivating innovative talents in higher vocational colleges through establishing mathematical modeling excellent technician class and taking mathematical modeling contest as the carrier, and finally expounded the implementation method and process of the model and the achievements made in the course teaching reform

Keywords: *Mathematical modeling technician class, Mathematical modeling competition, Innovation ability training, Advanced mathematics curriculum reform*

1. INTRODUCTION

According to the Implementation Plan of the National Vocational Education Reform, a number of innovative teaching teams for teachers in high-level vocational colleges have been established, and the pilot work of the system of "education certificate + several vocational skill level certificates" has been proposed, so as to build a curriculum system that connects vocational standards, serve the organic connection between "1" and "X", and promote classroom teaching reform.

Higher mathematics course is an integral part of the professional curriculum system and a public basic course in higher vocational colleges. However, it has not been paid much attention by students for a long time. Students have been lack of interest in mathematics since they think that mathematics is just useless and difficult theoretical calculation, but they do not see how to use mathematics specifically, and do not realize the importance of mathematics. Mathematical model competition is simplified by engineering technology, management science and social hot issues, which is close to life, and combines theory with practice. It is inevitable to let students make clear the solutions of mathematics to practical problems and carry out mathematics teaching reform based on mathematical modeling and application [1].

2. A NEW MODEL OF APPLICATION-ORIENTED PROJECT ORIENTED INNOVATIVE TALENT TRAINING BASED ON MATHEMATICAL MODELING

Nowadays, the demand for high-quality technical talents tends to favor the demand for compound talents, which requires them to have solid theoretical foundation, excellent practical ability, excellent psychological quality and innovative thinking with the times. The excellent technician class is a personalized training mechanism for technical talents with excellent quality, which meets the needs of the industry and enterprises for interdisciplinary talents by adopting the specially formulated talent training program and the combination of "production, study, research and application" teaching means. The so-called high-end skill posts require practitioners not only to have general operational skills, but also to master advanced knowledge and technology related to the post, and be able to carry out technological innovation on the post.

The goal of talent training in higher vocational colleges is to have high-skilled and complex talents with various vocational abilities so that they can have innovative talents with sustainable development stamina [2]. The ideas and methods of higher mathematics play an important role in students' professional learning, skill development and professional ability improvement. Mathematics course is the basis of learning all-natural and social sciences, and innovative composite talents are the needs of social development.

2.1. Modularized teaching content

Modularized teaching is guided by the result and determined by professional needs. The content of higher mathematics is divided into complex number, infinitesimal calculus of unary function, differential equation, infinite series, Laplace transform, linear algebra, probability theory and mathematical statistics.

2.2. Informatization on the teaching model

Optimizing the teaching resources and transforming the traditional means of plane teaching to network tools such as MOOC, QQ groups, and WeChat groups can change

traditional theoretical teaching to application, and give higher mathematics teaching content with a sense of the times. For example, the representation methods of functions include chart representation, image representation and analytical method, such as the mathematical modeling problem for northeast three provinces "Novel Coronavirus Pneumonia Analysis" (Table 1, Fig. 1, Fig. 2) [3]. How does the electronic eye on the road measure the instantaneous speed of a moving car? Using practical cases in life to carry out classroom teaching makes mathematics class have a strong sense of life, attracts students' attention to things around them, and trains students to use mathematics knowledge to solve practical problems and combine theory with practice.

Table 1. The cumulative number of confirmed COVID-19 cases in China, the United States and France and the number of new cases each day

Time	China		The United States		France	
	Cumulative confirmed cases	Newly increased	Cumulative confirmed cases	Newly increased	Cumulative confirmed cases	Newly increased
Mar. 1 st	80174	206	69	5	100	43
Mar. 2 nd	80302	128	89	20	130	30
Mar. 3 rd	80422	120	106	17	191	61
Mar. 4 th	80565	143	125	19	212	21
Mar. 5 th	80710	145	161	36	257	45
Mar. 6 th	80813	103	233	72	577	320
Mar. 7 th	80859	46	345	112	653	76
Mar. 8 th	80904	45	445	100	949	296
Mar. 9 th	80924	20	572	127	1212	263
Mar. 10 th	80955	31	717	145	1606	394
Mar. 11 st	80980	25	1010	293	1784	178
Mar. 12 nd	81003	23	1264	254	2284	500

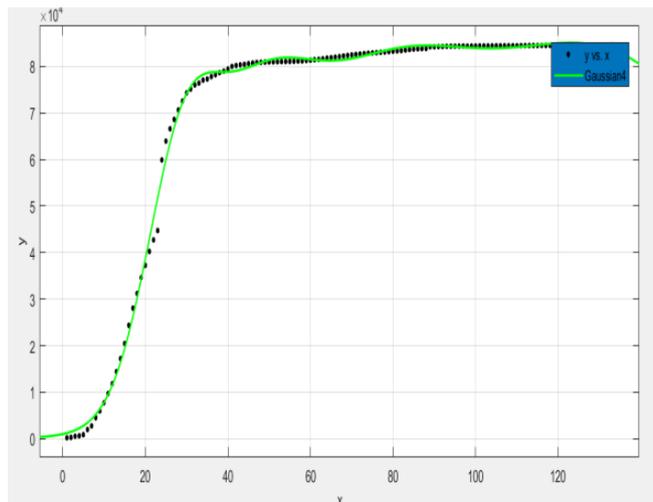


Figure 1. Trends of the number of confirmed COVID-19 cases in China

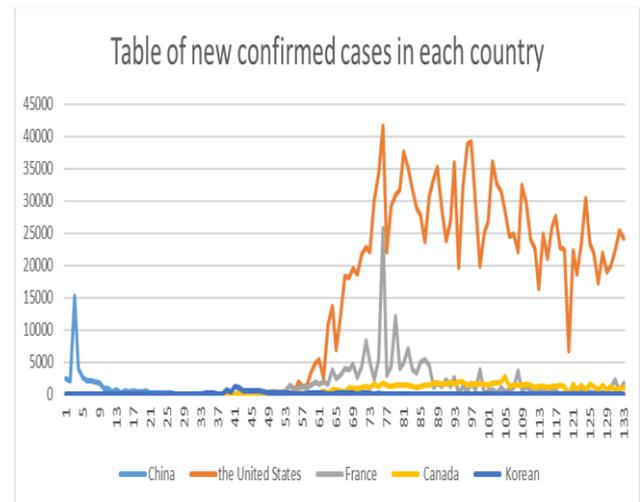


Figure 2. The curve of the number of new confirmed cases per day in each country

3. THE IMPLEMENTATION PROCESS

Based on mathematical modeling, the new model of higher mathematics teaching, which is application-oriented and project-oriented, is put into practice in the class of mathematical modeling technicians. The mathematical modeling is closely combined with the classroom teaching of mathematical modeling technicians, the activities of mathematical modeling association and the participation in the mathematical modeling competition.

4. PROMOTING AND STRENGTHENING THE LEARNING AND APPLICATION OF MATHEMATICAL MODELING

The implementation plan of the National Vocational Education Reform makes decisions and plans to build a group of teachers' teaching innovation teams in high-level vocational colleges, and proposes to launch the pilot work of the system of "education certificate + certain vocational skill level certificates", and build a curriculum system that connects vocational standards, so as to serve the organic connection between "1" and "X".

Mathematical modeling is an important bridge between mathematics and application, and it is the only way to apply mathematics [4]. Mathematical model competition is simplified by engineering technology, management science and social hot issues. There is no standard answer for the competition question, and the evaluation is based on the rationality of assumptions, creativity of modeling, correctness of results and clarity of expression. It is suitable for cultivating talents with innovative spirit and comprehensive quality, and the ability of students to analyze and solve practical problems by using mathematical modeling method can be trained through competition.

4.1. Setting up an excellent mathematical modeling technician class

Based on "National College Students Mathematical Modeling Competition", it is an effective way to set up an excellent technician class for mathematical modeling and develop mathematical modeling activities for the reform and innovation of higher mathematics curriculum [5]. In order to improve the students' practical application ability, it is necessary to integrate the ideas and methods of mathematical modeling into the higher mathematics classroom teaching in higher vocational colleges by setting up a mathematical modeling technician class.

Through the selection of students, a mathematical modeling technician class can be set up to formulate mathematical modeling technician talent training program, and organize teaching contents, teaching plan, and assessment program. Students were organized and trained to participate in the northeast three provinces mathematical

modeling league, and the 2019 national college students mathematical modeling competition.

4.2. Basic mathematical modeling teaching

It is an extension and application of advanced mathematics knowledge points to train the students of mathematical modeling technician class with the basic modeling idea and basic modeling method based on the result-oriented and application-oriented.

The teaching contents include excel data analysis, probability theory and mathematical statistics, linear algebra, mathematical modeling methods, and Matlab software, so as to solve the established mathematical model and writing papers.

4.3. Competition intensive mathematical modeling training

Combined with the real questions of previous competitions, the project teaching is strengthened and decomposed according to the real questions of the competition. The comprehensive modeling method is introduced by the task-driven method, and the students are strengthened to analyze the problems synthetically with the idea of mathematical modeling. Through contacting various types of practical problems, the omnidirectional energy of modeling ability is promoted. Students have been trained to pay attention to hot social issues, such as the new college entrance examination, student scheduling, air pollution, and real-time monitoring of air quality [6].

A study group with three participants is formed to implement the captain responsibility system. With the help of Internet information teaching platform, students' learning ability and problem-solving ability are cultivated, so as to promote the overall improvement of students' self-study ability, innovation ability, practical ability and comprehensive quality.

A mathematical modeling technician class is established to prepare for the establishment of mathematical modeling training room. In order to make up for the deficiency of traditional teaching, it is necessary to improve students' ability to learn mathematics, cultivate students' learning ability, innovation ability, team communication and cooperation ability, build a teaching platform for applied innovative talents who can fully relate to reality to establish mathematical models and solve practical problems, and promote the reform and construction of higher mathematics teaching in the college.

4.4. Using mathematical modeling competition to promote comprehensive ability

The first mathematical modeling excellent technician class was established in the form of voluntary registration, teacher recommendation and the selection of mathematics

competition. Through exploration and practice, a set of experience suitable for carrying out mathematical modeling activities in higher vocational colleges is found out. Through extensive investigation and practice, the talent training program of the mathematical modeling excellent technician class can be developed, and the teaching content and assessment program of the mathematical modeling excellent technician class are developed close to the actual mathematical level of students in the college.

The mathematical modeling activity chain of "propaganda, lecture, training, selection, intensive training and competition" is constructed. Training students to participate in digital-model competitions also improves teachers' teaching level and scientific research ability. The teaching reform of higher mathematics curriculum system, content and method is promoted, and the teaching quality of higher mathematics curriculum is improved.

Mathematical modeling competition is a rare innovative and exploratory practical training for students in college, which simulates the situation of finding solutions to practical problems after graduation. It enriches and enlivens students' extracurricular life and creates conditions for students to stand out. Mathematical modeling competitions help to train students' imagination,

insight and creativity, develop their spirit of solidarity and cooperation, organizational ability, and the ability to consult literature, collect data, and express words [7].

5. PRACTICAL RESULTS

5.1. Excellent results obtained in the mathematical modeling contest

In 2019, the five participating teams of the Mathematical Modeling League from three northeastern provinces won two first prizes and two third prizes.

The 2019 National Mathematical Modeling Competition for College students was held from 18:00 to 22:00 on September 12, 2019. Through the study of mathematical modeling technician class, the special training before the competition, and 3 days and 3 nights of team cooperation, all of them submitted their papers within the prescribed time. The college achieved the breakthrough in the national mathematical contest in modeling for college students.

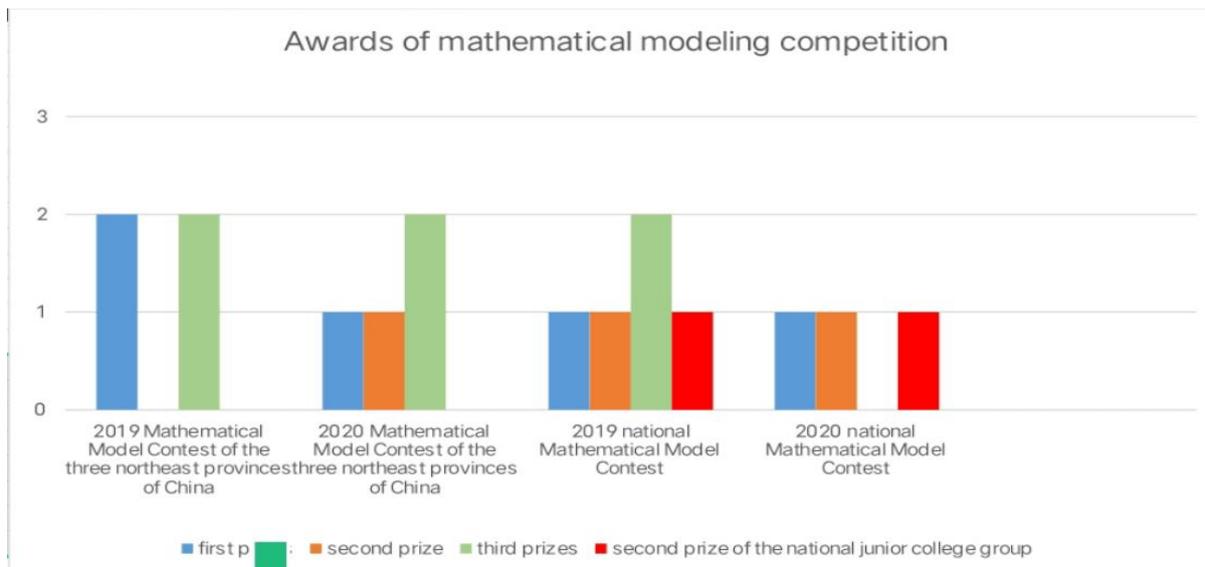


Figure 3. Awards of the mathematical modeling competition

The 2019 national college students mathematical modeling competition won the first prize, the second prize, and the third prize. The first prize paper of the first team won the second prize of the national junior college group, and the second prize of the national junior college group in Liaoning competition area.

By organizing and participating in Mathematical Model Competition and colliding with each other in mutual discussion and research, the best solution is to learn from the competition and compete in the competition. Some students said in the post-competition summary that "these days of competition can be said to be an unprecedented

learning experience", echoing the words of a mathematical model: "once the competition, lifelong benefits". Promote mathematics teaching with competition activities can let students enjoy the joy of learning brought by challenges, and promote learning by competition. Mathematical modeling contest is regarded as an effective way to cultivate students' practical and innovative ability and an important means to improve students' comprehensive ability.

In 2020, one team won the first prize, one team won the second prize and two teams won the third prize in the

Mathematical Model Competition of three provinces in northeast China.

In 2020, 4 teams of the national college students Mathematical Modeling Competition won the second prize, the first prize of Liaoning district, and the second prize.

5.2. Teaching staff construction

Organizing students to participate in all kinds of modeling competitions can improve the students' comprehensive ability and guide teachers' ability levels. In the process of training and guiding students to participate in the modeling competition, participating in the 15th and 16th National Mathematical Modeling Teaching and Application Conference, participating in the 15th and 16th National College students Mathematical Modeling Competition evaluation and experience exchange, students can follow the pace of the development of the times to study hard, and improve their own professional and technical level. Through the improvement of teachers' ability, students' interest and consciousness, students are guided to combine theory with practice and creatively analyze and solve practical problems.

5.3. Technician class students are recognized by employers

Students taking part in mathematical modeling training can improve their ability to analyze and solve problems, which is approved by employment units. For example, Zhang Jinshuo, Li Xiaopeng and other students of grade 19 talked with the interviewer about the process of taking part in the mathematical model contest for three days and three nights, they were admitted in the middle of the interview.

6. CONCLUSION

Through the development of mathematical modeling activities, the enthusiasm of students to learn mathematics and participate in mathematical modeling activities is greatly aroused. The competition questions of mathematical modeling competition all come from the reproduction of real problems in real-life production. Higher vocational students suffer from not knowing what mathematics is used and when to use it, so they lack enthusiasm for learning mathematics. By taking part in the mathematical modeling contest, students can truly realize that mathematics is not only useful, but also very useful. The application-oriented teaching model based on mathematical modeling competition is a new model of innovative talent cultivation and mathematics teaching

reform that explores the combination of theoretical learning and practical application. Cultivating and improving students' cooperative spirit and team consciousness provides students with a platform of emotional intelligence that not only fully demonstrates their individual intelligence but also contributes to the cultivation of cooperation with others. It also promotes the improvement of teachers' teaching level and scientific research level, and improves the teaching quality of higher mathematics courses.

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