

# Exploration and Analysis on Cultivating the Entrepreneurship and Innovation Ability of Higher Vocational Students Based on Mathematical Modeling Platform

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**Abstract**—The reform of public basic courses in higher vocational colleges should adapt to the new economic situation in China and cultivate students' innovation thinking and innovation ability. By building mathematical models, students can use mathematical theory to solve practical problems. In the process of problem solving, constructing a relatively complete mathematical knowledge system and exploring the application of mathematical knowledge is an important way to cultivate students' innovative consciousness, innovative spirit and post entrepreneurial ability. It is of great significance to cultivate students' core professional abilities such as problem solving, teamwork, information processing and professional communication. Through the analysis of the connotation of entrepreneurship and innovation ability of higher vocational students, a three-dimensional mathematical modeling platform is constructed through classroom teaching (modeling course + mathematics basic course combined with modeling idea) and extracurricular education (modeling contests and club activities) to achieve the cultivation of students' entrepreneurship and innovation ability.

**Keywords**—*Entrepreneurship and innovation; Mathematical modeling; Higher vocational*

## I. INTRODUCTION

The training objective of higher vocational education is to cultivate specialized talents of advanced technology application, so it is particularly important to cultivate students' problem-solving, practical application and innovative ability. Higher vocational education should attach importance to connecting students' professional learning needs and social life practice to improve students' comprehensive quality. Mathematical modeling is to build a corresponding mathematical model for a certain phenomenon in social reality by setting some simplified assumptions and refining the quantitative or geometric relationships in the actual problems, use mathematical methods and mathematical software to solve the model, draw mathematical conclusions, and develop solutions to practical problems. It has far-reaching significance for the cultivation of students' entrepreneurship and innovation ability. Most of the problems involved in mathematical modeling come from hot issues in society and life, and involve a wide range of fields. It

requires students to use their brains, broaden their thinking, and give full play to their creativity and imagination. At the same time, mathematical modeling requires repeated research and analysis of practical problems, abstraction and simplification, and quantitative analysis and discussion of main factors, and calculation, demonstration and revision through mathematical software, so mathematical modeling helps to develop students' mathematical application and practical ability, independent learning ability, creativity, and the spirit of diligence, excellence and perseverance. At the same time, the mathematical modeling process is equivalent to a small scientific research activity, which can be completed successfully only through teamwork among team members. It is also very beneficial to the cultivation of students' team spirit. Therefore, it is of great significance to build a multi-dimensional mathematical modeling platform, fully explore the elements of entrepreneurship and innovation education in mathematical modeling, and cultivate students' innovation, application and practical ability to achieve the goal of talent training in higher vocational education.

## II. OBSTACLES TO THE CONSTRUCTION OF MATHEMATICAL MODELING INTEGRATED PLATFORM IN HIGHER VOCATIONAL COLLEGES

### A. The concept of education and teaching is backward

At present, most higher vocational colleges only take mathematical modeling as a training course for students to participate in the national college students' modeling contests, and the understanding of the importance of mathematical modeling is insufficient, while the teaching concept of mathematics teachers in higher vocational colleges is relatively backward. In the teaching of mathematics courses in higher vocational colleges, the idea of mathematical modeling is not really integrated into teaching, let alone the systematic thinking of building a multi-dimensional mathematical modeling platform, and the function of mathematical modeling is not given full play. As a result, the improvement of students' comprehensive quality, such as mathematical literacy and innovative ability, always stays on the slogan. At the same time, in the teaching of mathematics courses in higher vocational

colleges, first, the course content is based on the theoretical knowledge of the subject system. In order to catch up with the teaching progress, the lessons are full of lectures and the cultivation of students' logical thinking, convergent thinking and divergent thinking is neglected, resulting in that students can only mechanically apply formulas or methods to solve problems and lack the ability of independent learning and independent thinking. Secondly, in the course teaching, the students' professional learning needs and the actual employment positions are separated. They do not pay attention to the application of mathematical theory knowledge and methods, and do not use mathematical modeling ideas to analyze and deal with practical problems. Or the cases are outdated and do not meet the needs of social and economic development, resulting in students' weak ability to analyze and solve production and living problems, resulting in a great discount of students' career transfer ability and career development potential.

### *B. The links of education and teaching are single*

The main performance is that mathematical modeling only stays in classroom teaching, and appears in the training program for higher vocational talents in the form of elective courses. In the actual teaching, the mathematical modeling course has not really carried out the analysis of the actual needs of students' majors, so it deviates from the needs of professional positions and blindly pursues the integrity of mathematical theoretical knowledge structure. Although the case analysis method is widely used in teaching, the cases are outdated and divorced from the reality of professional development. Extracurricular mathematical modeling education is almost a blank. Due to their weak mathematical foundation, students are afraid of difficulties in mathematical learning, which leads to their low participation in mathematical modeling learning and activities and their inability to experience the charm of mathematical modeling. Therefore, students lack comprehension of mathematical modeling and are afraid of it.

## III. RELATIONSHIP BETWEEN MATHEMATICAL MODELING AND THE CULTIVATION OF ENTREPRENEURSHIP AND INNOVATION ABILITY

(1) Innovative ability is the ability to use knowledge and theory to continuously provide new ideas, new theories, new methods and new inventions with various values in science, art, technology and various practical activities. [1] Mathematical modeling starts from problem analysis and variable refinement to stimulate students' innovative consciousness (innovative impetus, innovation initiative), puts forward reasonable assumptions through abstract summarization to exercise students' innovative thinking (observation ability, logical thinking, divergent thinking), improves students' basic ability of innovation (communication and communication ability, information collection ability, computer application ability, independent learning ability, essay writing ability) through model construction and model solving, and finally carries out group report and defense, writes modeling papers, and forms innovative quality (responsibility, organization and coordination ability and teamwork ability), fully explores the

innovative educational elements of mathematical modeling through deconstructing the innovative ability of higher vocational students, and studies the connection between the four links of mathematical modeling (data collection, hypothesis establishment, model construction and solution model) and the cultivation of innovative ability.

(2) The connotation of entrepreneurial ability has undergone profound changes. Entrepreneurial ability includes independent entrepreneurship and post entrepreneurship. For most higher vocational students, the cultivation of entrepreneurial ability is more focused on the cultivation of post entrepreneurial ability, that is, training students to establish the new concept of entrepreneurship of cultivating students' "ability to treat work with entrepreneurial mentality and innovative thinking" and "creating career on the job" after graduation, i.e. the cultivation of students' sustainable development ability in the workplace in the future. Mathematical modeling can cultivate students' divergent thinking in thinking and analyzing problems, convergent thinking in summarizing and abstracting problems, and reverse thinking in terms of results and causes, etc.. The submission of modeling papers can also cultivate students' communication ability, writing ability, computer operation, teamwork and other abilities, which is of great significance to support students' sustainable development in the future.

## IV. MEASURES FOR THE CONSTRUCTION OF MATHEMATICAL MODELING INTEGRATED PLATFORM IN HIGHER VOCATIONAL COLLEGES

### *A. Update our educational concepts and integrate the concepts of entrepreneurship and innovation*

The essence of mathematical modeling is the same as the concept of innovation and entrepreneurship. The mathematical modeling process is the process of finding problems - analyzing problems - building models - solving models - solving problems, and the cultivation of innovative and entrepreneurial ideas follows the process of professional needs - creative generation - innovative thinking - entrepreneurial consciousness. From the construction of mathematical modeling integrated platform, the concept of entrepreneurship and innovation should run through every link of the construction of the entire mathematical modeling platform system in higher vocational colleges, from the construction of the teaching staff to the reconstruction of the course content, the design of teaching activities, the development of teaching resources, the innovation of teaching methods, the reform of teaching evaluation, etc., all of which should be integrated into the concept of entrepreneurship and innovation and guided by the concept of entrepreneurship and innovation. First of all, in the construction of the teaching staff, by participating in various types of training, such as the improvement of entrepreneurship and innovation guiding ability and the development of specialty and entrepreneurship and innovation integration courses, the mathematics teachers in higher vocational colleges can master the core elements to integrate entrepreneurship and innovation guidance into course construction, course design, difficulties and breakthrough skills and methods, can guide students to build entrepreneurship and innovation teams, stimulate students' innovative consciousness

and guide students to declare utility model patents, software copyrights, etc., explore and operate entrepreneurship and innovation projects, and guide students to write business plans and participate in various innovation and entrepreneurship competitions at various levels, thus creating a high-quality faculty with both professional knowledge and entrepreneurship and innovation ability. Secondly, in the teaching content reconstruction of mathematics courses in higher vocational colleges, study the training plan of professional talents, analyze the support points of mathematics curriculum to achieve the training goal of professional talents, investigate the core courses of various majors based on students' professional needs and job analysis, consult and exchange with teachers of professional courses of the class, consult professional basic books, basically sort out the mathematical knowledge required by various majors, and refine typical cases of various majors, such as the optimization in management major, logistics and distribution, insurance, investment and financial management in finance major, property management in accounting major, accounting decision-making and so on. Combining with students' professional learning needs, flexibly and dynamically set up teaching content modules of the course, set up different mathematics courses for different majors, and construct a curriculum system oriented to professional needs, with project as the carrier, and combined with mathematical modeling, in order to achieve the purpose of cultivating students' awareness and methods of using mathematics and improving their ability to use mathematics. Third, in the design of teaching activities, group contests, cooperative learning, small lectures, special seminars, mathematics experiments, etc. can be carried out in the class, and special lectures, social practice, patent application, mathematical modeling contests and other activities can be carried out outside class by relying on mathematical modeling associations, mathematical modeling studios and entrepreneurship and innovation teams. Fourth, in terms of the development of teaching resources, the course cases should be updated dynamically to keep up with the development status of social economy, the form of micro-course resources should be innovated, and the design of learning assignment books should conform to the learning characteristics of students at different levels. Fifth, in the innovation of teaching methods, the task-driven method, case teaching method, situational teaching method, brainstorming method, inquiry method, focus method, discussion method and other teaching methods should be used reasonably, and the information teaching platform should be fully utilized to implement mixed teaching. Finally, in the reform of teaching evaluation, the content of evaluation and assessment changes from mathematical theory knowledge to mathematical ability and methods to solve practical problems. The method of evaluation and assessment changes from regular exams in class to submitting solutions after class, and the results of evaluation and assessment change from mathematics paper to modeling scheme (thesis), and the indicators of evaluation and assessment reflect the evaluation of the learning process. In addition, students' self-evaluation can also be added. Self-evaluation plays an important role in cultivating students' self-management ability.

#### *B. Architecture of mathematical modeling integrated platform based on entrepreneurship and innovation concept*

Based on the analysis and deconstruction of the entrepreneurship and innovation ability of higher vocational students, deeply explore the entrepreneurship and innovation education elements of mathematical modeling. First, break through the traditional mode of mathematics teaching in higher vocational colleges, and strengthen the cultivation of modeling ideas in the classroom teaching of higher vocational mathematics courses, pay attention to cultivating students' innovative spirit and practical ability in daily teaching, pay attention to cultivating students' ability of analyzing and solving problems, focus on cultivating students' application consciousness and teamwork spirit. [2] Reform the teaching mode of mathematical modeling elective courses and other higher vocational mathematics courses, consolidate entrepreneurship and innovation education through course construction and reform, and offer elective courses of mathematical modeling for the whole college and develop school-based textbooks of mathematical modeling. Second, build a mathematical modeling platform combining classroom teaching with extracurricular education, and create an entrepreneurship and innovation environment through platform construction. Select students with strong interest in mathematics to form mathematical modeling clubs, and teachers guide students to carry out mathematical modeling activities, such as popular science lectures on mathematical modeling, college-level mathematical modeling contests, special lectures, social practice (research, service), etc.. Drive more students through the clubs to know mathematical modeling, understand mathematical modeling, love mathematical modeling and join the team of mathematical modeling, expand the beneficial range of mathematical modeling. Select students with mathematical modeling contest experience or good mathematical foundation to form mathematical modeling studios, guide students to combine mathematical modeling with professional learning, carry out scientific and technological innovation, think deeply, imagine boldly, explore innovation points, use mathematical software and statistical software for data processing and mining, and apply for utility model patents or software copyrights. The application of mathematical software also provides modern mathematical tools for students to solve problems in their future careers [3]. Third, guide students to participate in the national mathematical modeling contests for college students and various types of entrepreneurship and innovation contests at all levels. The mathematical modeling contests for college students with the tenet of "innovative consciousness, team spirit, participation and fair competition" provides an important way for cultivating innovative applied talents [4]. The mathematical modeling contests will not limit the selection and use of mathematical methods. At the same time, there is no standard answer and standard method for establishing mathematical models for practical problems. Different understanding and emphasis on the relationship between variables in practical problems will lead to different ideas for solving problems and building mathematical models. Therefore, the participants can sort out the relationship between variables, set up problem hypothesis, build mathematical models, solve mathematical models, explain the model results, and write

modeling papers based on the research on the actual problems, data and related materials, which is very beneficial to the cultivation of the participants' innovative consciousness and creativity.

## V. CONCLUSION

Promote teaching, mutual integration and convergence through courses, activities, competitions and other ways, and improve students' level of entrepreneurship and innovation. Integrate mathematical modeling into the fields of students' professional study, curriculum teaching, extracurricular activities, etc., and effectively enhance students' innovative and entrepreneurial ability through the practice of solving practical problems by synthetically applying specialized knowledge and mathematical knowledge.

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