

Research and Practice on Teaching Content and System of Ordinary Differential Equations Course Based on Collaborative Innovation

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Keywords: Ordinary differential equations, Course teaching, System research

Abstract: In the research and practice of the teaching content and system of ordinary differential equations, the integrable theory of ordinary differential equations, the important thinking method of ordinary differential equations, and the relationship between ordinary differential equations and middle school mathematics were discussed deeply, and then a prominent The framework of ordinary differential equations curriculum system with the characteristics of teachers and reflecting the achievements of modern theory. As an important part of contemporary disciplines, ordinary differential equations not only provide an important basis for the development of science, but also lay a good foundation for the development of human civilization and society. In view of the problems existing in the course, under the guidance of the teaching mode of “emphasizing foundation”, “attaching importance to application” and “developing frontier”, this paper puts forward some thoughts and suggestions on the reform of the teaching content of the course of ordinary differential equations. Based on the understanding of the actual situation of the teaching mode of ordinary differential equations, this paper puts forward the theoretical basis and implementation points of the reform of the teaching mode of ordinary differential equations in order to improve the teaching quality and enhance the students' interest in learning, thus laying a solid foundation for cultivating high-quality talents in line with the development of the times.

1. Introduction

Colleges and universities are the main position of national talent training, and undertake the historical task of training socialist builders for the rejuvenation of the Chinese nation and the happiness of the Chinese people [1]. With the development and demand of science and technology, a large number of practical problems in many disciplines (such as biology, chemistry, engineering technology, economics and social sciences, etc.) need to establish mathematical models through differential equations, and study the structure and properties of the solutions of differential equation models to solve practical problems. Therefore, it is necessary to theoretically guarantee the existence, uniqueness and smoothness of the solutions of ordinary differential equations, instead of sticking to solving ordinary differential equations [2]. Ordinary Differential Equations, as a basic

course for mathematics and applied mathematics, information and computing science majors, plays a role as a link between the past and the future in the prerequisite courses “Mathematical Analysis”, “Advanced Algebra” and the subsequent courses “Differential Geometry” and “Partial Differential Equations”. It plays an extremely important role in the cultivation of students' mathematical literacy, ability to analyze and solve practical problems [3].

In particular, with the advent of modern information and technology society, differential equation, as an important means of mathematical modeling, plays a powerful role in solving practical problems [4]. Therefore, the research and practice of the teaching content and system of ordinary differential equations has become an important subject of mathematics teaching reform in normal universities [5]. 为 In order to improve the quality of teaching, strengthen the construction of courses, and promote the overall quality of students, especially the improvement of application ability and innovation ability, this paper combines the actual situation of the school, based on professional construction and development, in “emphasis on foundation” + “emphasis on application” + “development”. Under the guidance of the teaching mode of “Frontier”, this paper puts forward some thoughts and suggestions on the reform of the teaching content of ordinary differential equations. Only by doing a good job in teaching construction can we ensure the teaching effect and improve the teaching quality. The teaching mode is an important content of teaching construction. Ordinary differential equations are the basis of courses such as partial differential equations, advanced mathematics and mathematical modeling, and are the continuation of mathematical analysis. It is also a basic tool and means to study the laws of motion and evolution in natural sciences and social sciences [6].

2. Problems in Classroom Teaching System of Ordinary Differential Equations

2.1 The Theoretical Derivation Process is Lack of Necessary Enlightenment

In class, some teachers just step by step, instilling the formulas and principles in books in students according to a specific format [7]. In this process, students can only passively accept and memorize formulas, and lack their own learning and thinking [8]. One of the characteristics of ordinary differential equation course is its strong applicability. It is widely used in various fields of natural science and social science, and has made many important achievements. If these achievements are combined with ordinary differential equations in the teaching process, it will get twice the result with half the effort to attract students' attention, stimulate students' learning interest and subjective initiative, enrich classroom teaching content and improve classroom learning effect. This is not only an embodiment of combining the theoretical knowledge of ordinary differential equations with practical application, but also the need for colleges and universities to cultivate applied talents [9]. At present, the problems faced by the course are mainly manifested in many contents and few class hours. Moreover, the theory of this course is too strong, and the traditional teaching method pays attention to deductive proof and operation skills, ignoring the cultivation of understanding and application and students' innovative ability, which increases the difficulty of students' learning, thus causing some students to be afraid of difficulties in mathematics course, and affecting their enthusiasm and interest in learning. Therefore, on the basis of respecting traditional teaching methods, the reform of teaching methods should embody the teaching concept of teacher-oriented and student-centered, fully stimulate students' interest in learning, and cultivate students' innovative consciousness and ability [10]. Through the improvement of teaching content and teaching methods, students' interest in learning has been stimulated, and students have changed from passive learning to active learning, which not only greatly improves the teaching effect, but also enables students to subtly apply these ideas and methods to other professional courses. In

practice, students can grasp a solid theoretical foundation in comparison, thinking and summarization, and improve their problem-solving ability. As we all know, the ultimate purpose of learning is to apply what we have learned, and the course of ordinary differential equation has strong applicability. Therefore, in the daily teaching of the course of ordinary differential equation, we should pay attention to integrating theory with practice, which can not only expand the vision of students, but also cultivate their learning interest and enhance their initiative.

2.2 The Single Teaching Means Imprisons Students' Divergent Thinking

At present, the classroom teaching in colleges and universities is still dominated by teachers' teaching, which does not give full play to the subjectivity of students' learning, and the teaching of knowledge is still one-way instillation. After a class, there is very little interaction between teachers and students, and the class is over after the PPT is finished, so that students' autonomous learning ability cannot be improved, which is not conducive to students' comprehensive development. In teaching, teachers are often based on teaching materials, ignoring the expansion of students' thinking and lack of extension of extracurricular knowledge, so that students' horizons can not be expanded and their understanding of knowledge is easy to be one-sided. By studying this course, students can deepen their understanding of basic knowledge such as mathematical analysis and advanced algebra, improve their application ability, provide problem-solving methods and tools for subsequent mathematics and applied mathematics courses, and make this course an important bridge to various applied disciplines and engineering technology. By studying this course, we can deepen our understanding of basic knowledge such as mathematical analysis and advanced algebra, improve our application ability, provide methods and tools to solve problems for subsequent courses of mathematics and applied mathematics, and make this course an important bridge to various applied disciplines and engineering technologies. In order to solve the problems of students' curriculum teaching, serve the national major talent demand and local economic and social development, improve the quality and level of students' curriculum teaching, and optimize and perfect the content and methods of postgraduate curriculum teaching, this paper constructs a brand-new “six in one” curriculum teaching system. As shown in Figure 1.

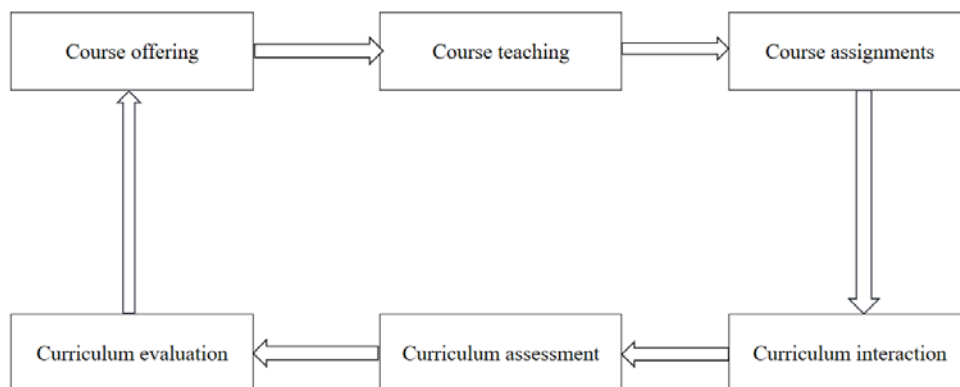


Fig.1 “Six in One” Student Curriculum Teaching System

When teaching, consciously introduce some examples of modeling using differential equations, guide students to understand some basic ideas of mathematical modeling, and guide them to use software to find solutions to problems according to the established models. Teachers should pay attention to the relevant background knowledge of teaching. Through geometric simulation, students can have a clearer understanding of ordinary differential equations, better understand the

source of equations and the idea of solving problems, and make abstract problems more visualized, so as to overcome the obstacles in understanding. For the difficulties encountered by students in the learning process, they should be given intensive lectures and slow lectures as special modules, and the corresponding exercise training should be done well, so as to continuously consolidate the knowledge they have learned, so as to continuously solve problems in the interaction between teachers and students and individual counseling, and improve the teaching efficiency in the interaction

3. Ordinary Differential Equations Course Teaching Content and System Conceptual Framework

3.1 Establish a New System of Ordinary Differential Equations Course Content

The establishment of ordinary differential equation course content system mainly includes three modules: theory module, equation solving module and Application module. Among them, the study of theoretical module is to enable students to have a preliminary understanding of ordinary differential equations and make a correct judgment on the existence and uniqueness of the solutions of the equations; Equation solving module is the key point of learning, and it is involved in each chapter of the module. Different methods need to be classified and summarized for different equations, so as to impart more systematic knowledge to students and help them absorb new knowledge. Application of modules is the ultimate goal of learning, and the idea of applying what you have learned is embodied here. In the process of teaching, you need to combine Mat-Lab software or Mathematica software to solve some equations. In addition to classroom teaching, some open application problems can also be arranged to allow students to answer according to the requirements of mathematical modeling, so as to continuously strengthen and consolidate students' ability to deal with practical problems, and practically apply the theoretical knowledge they have learned. actual.

The teaching of ordinary differential equations focuses on studying the solutions of various equations and discussing the properties of solutions. In daily teaching, cumbersome mathematical symbols and complex graphics are often involved, which brings great difficulties to teaching. Computer software is specially designed for the calculation and processing of mathematical formulas, functions and data. Using computer software can greatly promote the study, teaching and research of ordinary differential equations. For the theorems and related proofs of the theoretical part of the equation, we will explain them selectively, focusing on the proof ideas and methods. For the teaching method of ordinary differential equations, it can be taught in a variety of ways. In this process, the teacher plays the role of a guide. What the teacher needs to do is to classify and summarize the problems encountered by the students in the learning process, and to clear the problems encountered by the students through the explanation of typical examples Obstacles make students full of confidence on the road of learning ordinary differential equations, so as to solve more practical problems in the exploration, and truly realize that ordinary differential equations play a more important role in the information age. Figure 2 shows the survey results of the main difficulties encountered by students in the modeling process. It can be seen that transforming practical problems into mathematical problems is a common difficulty for students in the modeling process.

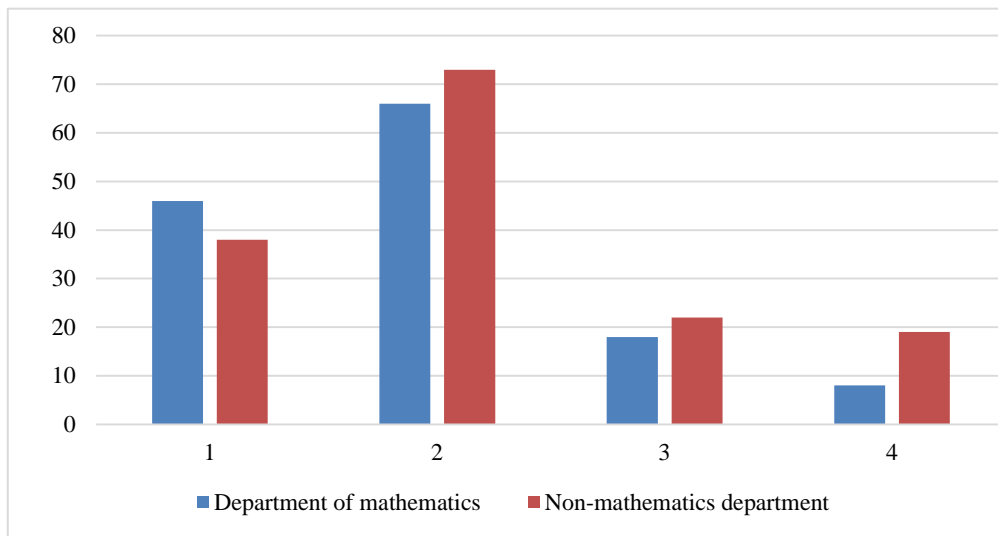


Fig.2 Survey of Modeling Difficulties

3.2 Introducing Mathematics Software to Assist Teaching

The auxiliary functions of mathematical software to ordinary differential equations are mainly reflected in: 1. Calculation of exponential functions, matrix eigenvalues and eigenvectors, and solutions to algebraic equations and systems of equations; 2. Draw the direction field and integral curve graph, trajectory graph, numerical solution of the differential equation and its graph of the first-order differential equation; Special and direct solving of ordinary differential equations and systems of equations. At present, the mathematical software commonly used in ordinary differential equations are Mathematica, Matlab and Maple, among which Mathematica language is mostly used in physics majors, and its symbolic operation, numerical calculation and graphic drawing are featured, and it has the functions of drawing, precise calculation, and simple formula derivation. and other functions; Matlab language is mainly used in the field of engineering and scientific computing, and is widely used in drawing, mathematical computing, engineering computing and simulation. Differential equation modeling is an important part of mathematical modeling. Through modeling, complex problems can be simplified, and the motion process of protons in the ideal state can be simulated in the form of equations, which has obtained good benefits in the application of cases. Compared with the former, higher-order differential equations involve more variables and are the theoretical basis of the solution of linear equations with variable coefficients, including the solution of special higher-order equations and the idea of coefficient variation. Differential equation group is a combination of differential equations, which covers the theoretical basis of the solution of linear equations. In the process of solving, it involves the idea of analogy reduction, and it is a more direct solution to simple equations. In this process, the teacher acts as a guide. What the teacher needs to do is to classify and summarize the problems in view of the difficulties encountered by the students in their studies. Through the explanation of typical examples, the obstacles encountered by the students in their studies can be dredged, so that the students are full of self-confidence on the road of learning ordinary differential equations, thus solving more practical problems in exploration, and truly realizing that ordinary differential equations play a more important role in the information age.

4. Conclusions

To sum up, ordinary differential equations integrate various elements such as mathematical

ideas, physical knowledge, and logical reasoning. The strong theoretical nature is one of the important characteristics of this course. In the process of reforming the teaching mode of ordinary differential equations courses, it is necessary to change the traditional teaching mode as the foundation, focus on the cultivation of mathematical thinking as the guiding ideology, consider the different learning psychology and personality differences of different students, and teach students in accordance with their aptitude is the fundamental theoretical basis. Supplement, update and design teaching content. As far as teachers are concerned, ordinary differential equations embody the essence of teaching ideas, which helps us to better understand and learn how to teach. In view of the problems that arise in our own work, we should face and think with positive thoughts, so as to master students' psychology in the teaching process, better serve the teaching, and convey the ideas of ordinary differential equations deeper and further. This is not only our duty, but also our obligation. The reform of the teaching content of ordinary differential equations has a long way to go. Educators should constantly innovate it with the vision of scientific development and in a step-by-step manner, so as to improve students' learning enthusiasm and initiative, cultivate students' ability to analyze and solve problems, stimulate students' innovative ability, and cultivate high-quality applied talents for the society.

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