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Exploration and Practice of the Course System Reform of Ordinary Differential Equation

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Abstract. Objective: In order to solve the problems and shortcomings of the course system of ordinary differential equation, this paper intends to study the reform and practice of the course system of ordinary differential equation from multiple angles and in a deep level from teaching content, teaching mode, teaching method, assessment mode and other links. Methods: Efforts to improve and adapt to the reforming teaching Methods and means of hardware environment, strengthen to the ordinary differential equation with subsequent professional course and the combination of actual demand, through perfecting and strengthening the construction of teaching staff, effective use of the network, for class, multimedia resources, such as the liberation from the heavy task of teaching teachers, devoted himself to scientific research and teaching reform, promote teaching by scientific research, in order to improve the quality of teaching reform. Results: The author applied the research methods to the relevant majors of Northeastern University and Shenyang Jianzhu University and achieved good Results. Conclusion: Based on the differential equation of classroom teaching content, teaching mode, teaching method, examination mode reform and practice, make the students' comprehensive ability to use mathematics to solve practical problems related common enhancement, student's result, pass rate are improved obviously, and the students' ability of learning mathematics, mathematical modeling ability and the ability to use mathematical software to get larger ascension.

Introduction

Ordinary differential equation is one of the compulsory basic courses for mathematics majors. It is the application and development of mathematical analysis, advanced algebra and analytic geometry. The purpose of this course is to learn and gradually master the basic theories and methods of ordinary differential equations, learn the thought and methods of establishing and solving deterministic mathematical models, and apply mathematical theories and methods to solving practical problems [1]. The study of this course not only prepares methods and tools for solving problems for subsequent mathematics courses, but also relates to whether students can use mathematics as a tool for professional research and use mathematical thinking methods to solve practical problems in the future[2].

As the related theories of ordinary differential equation are very abstract, and our school has also reduced the time of study (from 56 to 48 class hours) after enrollment in major classes, which makes it more difficult for students to learn this course. Specialized courses for our school's mathematics teaching focus is to train students with mathematics theory solution actual problem ability, but the current teaching of the course content and system of relatively old, content classic, lack of ideas, views and methods of the modern mathematics curriculum content does not reflect the discipline at the forefront of the dynamic, more not proactive. In terms of teaching evaluation model, the traditional teaching evaluation model is largely limited to homework, quizzes, exams and other methods. This evaluation model is relatively simple, but it also emphasizes too much basic knowledge, thinking of solving problems and examination of problem-solving ability, which cannot fully reflect the quality and ability of students. In addition, there are still some problems in the overall design of this course, such as

not paying attention to cultivating students' awareness, interest and ability of applied mathematics, lack of corresponding practical teaching links, single textbook model and lack of levels. Therefore, in the teaching practice of ordinary differential equation course, how to cultivate students' mathematical learning ability and make students use mathematical thinking method to solve practical problems has important theoretical significance and research value, which is an urgent problem that teachers need to deeply study and explore [3-4].

This paper intends to study the reform and practice of the course system of ordinary differential equation from multiple angles and in a deep level from teaching content, teaching mode, teaching method and assessment mode [5]. Efforts to perfect and reform the teaching methods and means of appropriate hardware environment, will strengthen the ordinary differential equation with subsequent professional course and the combination of actual demand, through perfecting and strengthening the construction of teaching staff, effective use of the network, for class, multimedia resources, such as the teachers from the onerous task of teaching, to scientific research and teaching reform, promote teaching by scientific research, to reform and improve the teaching quality, thus further deeper professional other courses of mathematics curriculum system and teaching methods play an exemplary role and try to explore [6-7].

The Reform and Exploration of Teaching Content

The reform of teaching content is the key and difficult point of teaching reform of ordinary differential equation, which embodies the education target and training mode. Due to the reduction in school hours, the teaching content was arranged in a scientific and reasonable way without changing the requirements of the syllabus. Specific reforms are as follows [8-9]:

First, the important and core contents should be explained in detail. For example, the content of equation can be divided into four parts: equation solution, equation theory, application of equation and introduction of modern theory of equation.

Second, theorem of minority is difficult, not detailed proof process, students are required to remember the theorem, application theorem to solve mathematical problems, such as: solution for initial value theorem of continuous dependence of intuitive geometric interpretation, only do omit multifarious proved that not only complete the outline requirements, but also make the students to understand the purpose of the content.

Third, on the basis of reading the textbook and understanding the content, some chapters in the textbook are handled flexibly. For example, when teaching the "continuity and differentiability theorem of solution to initial value" in chapter 3, "existence uniqueness theorem of solution and stepwise approximation method", we can only introduce qualitative conditions and conclusions, without making specific deduction and proof. For example, in chapter 5, "linear differential equations", and then in chapter 4, "higher order differential equations", "higher order differential equations" can be regarded as a special case of "linear differential equations". In this way, many formulas and theorems in chapter 4 need not be proved again, which can avoid repetition in classroom teaching, save a lot of hours, and effectively alleviate the contradiction of reducing the number of hours in middle school in curriculum reform.

Fourth, in order to encourage students to autonomous learning, cultivate the students' self-study ability, promote the teachers and students interactivity, parallel to the relative content, let the students themselves, and then review together by teachers and students, in addition, appropriate increase new ordinary differential equation integral types, a modest increase in the ordinary differential equation modeling, model, technical innovation model, such as fishing pendulum problem, population problem, infectious diseases, etc., and combined with Matlab software or demonstrate these equations solving process Mathematic software, explanation of some actual phenomenon. This teaching process avoids the monotony of teachers' pure theoretical explanation, makes students try to solve practical problems by using equations, improves students' learning ability, and enhances their confidence and initiative in learning.

The Reform and Exploration of Teaching Mode

In teaching, a "modular" teaching model integrating "basic module + application development module + postgraduate entrance examination and further study module" is introduced. As shown in the Figure 1. "Modular" teaching is conducive to the continuous improvement of teaching quality and strengthening the cultivation of students' practical innovation ability [10]. The basic module is based on classroom teaching, enabling students to master the basic knowledge and basic skills required by teaching. The tutoring module mainly focuses on after-class tutoring, mainly facing students from the middle and lower classes, so as to enhance their understanding and grasp of what is taught in class. At the same time, we provide feedback information through the problem record card at any time, making the coaching content more targeted and effectively ensuring the improvement of the teaching quality of this part of students. Research extension module in the form of open discussion is given priority to, mainly for the better, do not have enough to eat in class, students design workshops, and writing papers, based on college students' innovative projects, make this part of the students give full play to the advantages, constantly improve the level of the students' study enthusiasm, to ensure the improvement of teaching quality. And strengthen the practice teaching link, add the mathematics experiment big homework. In the teaching of ordinary differential equation courses, the training of Mathematics and other mathematical software packages to solve the initial ability of differential equation problems is integrated into the teaching of ordinary differential equation courses, so as to reduce the burden of calculating by traditional methods and make up for the deficiencies in traditional teaching.

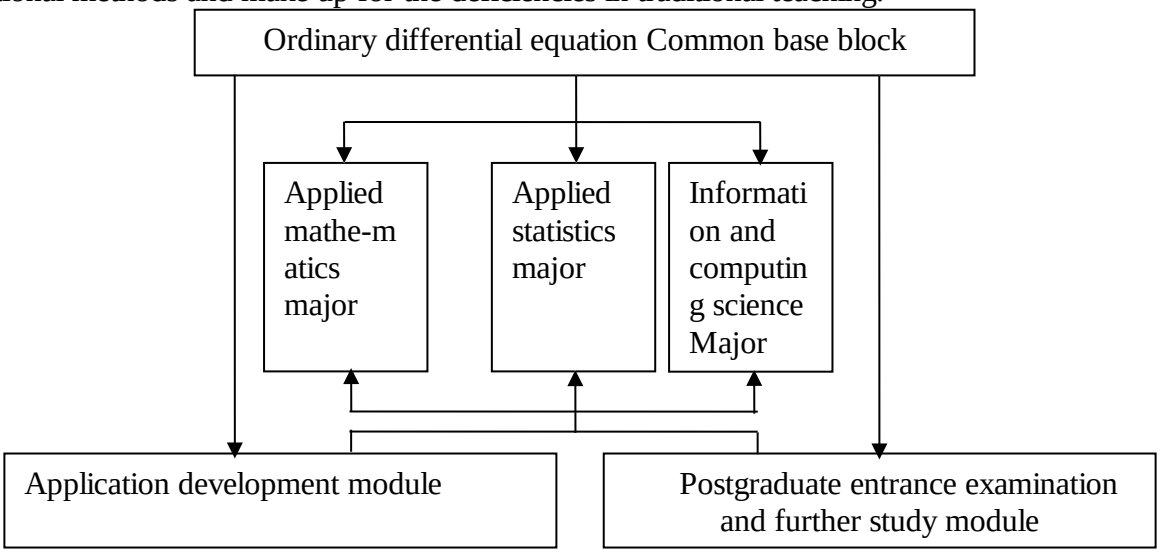

Figure 1. Ordinary differential equation course framework

Reform and Exploration of Teaching Methods

It is the key to improve teaching quality to adopt diversified teaching methods and improve students' learning enthusiasm. In order to demonstrate the infiltration of theoretical methods, modeling and computer software into this course, and improve students' ability to apply knowledge, the course pays attention to cultivating students' learning ability [11-12]. Ordinary differential equation for profound theories, abstract concepts, content, more widely used, etc, also in order to adapt to the requirements of quality education in today's society for talents training, pay attention to the cultivation of student's innovation ability and comprehensive quality, improve the teaching mode, in the teaching of differential equation to strengthen the cultivation of student's ability to make the following several aspects:

The cultivation of abstract thinking and logical reasoning ability. Ordinary differential equation of course the biggest characteristic is to abstract, and strong logicality, class how to make the abstract concept of popularization, concise, complex knowledge in limited time, how to make students get maximum mathematical thinking training, often get maximum differential equation of knowledge acquisition is the basic task of the a math teacher. In order to truly grasp the essence and essence of

mathematics, it is necessary to have strong abstract thinking and logical reasoning ability. For the basic theory of mathematics, it is important to clearly explain the main problems, core concepts and main ideas.

The cultivation of innovative thinking ability. While imparting knowledge to students, teachers should also focus on cultivating students' innovative thinking. The most important components of innovative thinking are perception thinking, seeking for differences, reverse thinking and divergent thinking. To cultivate students' innovative thinking is to cultivate students' spirit of thinking more about problems. In addition, the cultivation of innovative thinking should also pay attention to strengthening the comprehensive use of mathematical knowledge.

The cultivation of practical ability. The duty of teachers is not only to impart knowledge, but also to help students improve their ability to analyze and solve problems, so as to achieve the purpose of applying knowledge. Therefore, in addition to explaining the context and interconnection of knowledge, teachers should also teach students how to think and study problems, which are often difficult to find in books. Teaching the fundamental purpose is to let students not only remember about knowledge and method, but it should be made students develop ways to use knowledge, consciousness and ability, so that the students are good at their knowledge to practice and master the skills, solve problems arising from the actual situation, cultivate their ability of applying algebra and habits, good future studying other subsequent professional course and ordinary differential equation of the interface.

Reform and Exploration of Assessment Model

Examinations are an important part of the teaching process and one of the main methods of testing teaching results. Past exam is the traditional examination system, the test focuses on examining students' understanding of the book knowledge, is not conducive to the cultivation of the students' ability of innovation and application method is simple and only in the final exam, students usually study pressure is not big, can't mobilize the students' interest in learning, also hinder the improvement of teaching quality. In the course of learning ordinary differential equations, many students lack the consciousness of independent learning, plagiarize homework and rely on the final exam.

According to the characteristics of ordinary differential equation courses, the reform of examinations can disperse the scores in ordinary grades, stage exams and final comprehensive examinations, which will break the original concept of success or failure based on final exams. (1) peacetime performance: urge and warn students through attendance, homework, quizzes and classroom questions, accounting for 20% of the final grade; (2) exam: during the period of teaching with two or three phased examination, pay attention to on the investigation to the students' knowledge, 20% of your final course grade, stage test including the determination of the number and time, the examination content, topic quantity and ease, the arrangement of the test proctors, examination paper evaluation, published results, should also include the make-up exam; (3) final comprehensive examination: arranged together with the final examination, unified proposition method, mainly assessing the learning content of the later period and the mastery of the whole course, paying attention to the investigation of students' overall ability. Due to the particularity of ordinary differential equation courses, it is still a closed exam with 60% of the scores.

Conclusions

Ordinary differential equation from the Angle of the classroom teaching content, teaching mode, teaching method, examination mode reform and practice, make the students' comprehensive ability to use mathematics to solve practical problems related common enhancement, student's result, pass rate are improved obviously, and the students' ability of learning mathematics, mathematical modeling ability and the ability to use mathematical software to get larger ascension.

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References

[1] G.X. Wang, Z.M. Zhou, S.M. Zhu, S.S. Wang, Ordinary differential equations, third ed., higher education press, Beijing, 2006.
[2] D.Q. Li. Integrate mathematical modeling ideas into the main course of mathematics, Chinese University Mathematics, 1 (2006) 9-11.
[3] Z. G. Wang, Teaching reform and practice of ordinary differential equation course in undergraduate universities, Education Theory and Practice, 21 (2015) 56-57.
[4] Y.X. Zhou, X.X. Jiang, X. Wei, Discussion on teaching reform of ordinary differential equation, Mathematics Teaching Research, 32(2013) 63-65.
[5] J. Zhu, X.H. Chen，L.M. Cao, Study on permeating mathematical modeling thought in ordinary differential equation teaching, Journal of Science of Teachers' College and University, 35 (2015) 50-54.
[6] Q.H. Liu, Research on the reform of teaching content of ordinary differential equation, Journal of Chengdu Normal University, 33(2017) 115-117.
[7] R. Wang, Teaching model reform of ordinary differential equation in applied universities, Yinshan Journal of science, 31(2017) 120-121.
[8] C.D. Zhao, W.M. Wang, Y.L. Ying, et al. Research and practice on teaching reform of ordinary differential equation courses -- exploration on innovative teaching model of mathematical application, Journal of Ezhou University, 21(2014) 97-98.
[9] C.H. He, Q.Z. Zheng, L.N. Ji, Exploration and practice of the teaching reform of ordinary differential equation courses, Journal of Henan education college (natural science edition), 23(2014) 68-69.
[10] Y.S. Lu, Y.H. Lin, S. Zhou, Discussion on teaching reform of ordinary differential equations, Education Teaching Forum, 29 (2013) 62-63.
[11] S.P. Bai, Discussion on teaching methods of ordinary differential equation, Journal of Inner Mongolia university of nationalities (natural Chinese version), 4 (2013) 401-403.
[12] C.Y. Wang, Teaching reform and practice of ordinary differential equation course, Journal of Xinzhou Normal University, 31(2015) 79-80.