Discussion of Class Teaching of Ordinary Differential Equation on the Basis of Ability Training

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Abstract. Differential equation theory is originated in the natural sciences, grows up with calculus together, is the powerful weapon to accurately describe all kinds of basic problems and the basic laws of the material world. Ordinary differential equation is one of the core of mathematics specialized fundamental course in high schools, and is also an important learning content for engineering professional of higher mathematics, is a discipline with strong application. ODE is a required course for students majoring in mathematics. The course itself has both the basic theory of heavy and complicated and closely linked with actual practice. Therefore, combined with the characteristics of the subject, to strengthen the cultivation of student's ability to analyze problems, solve the problem in the teaching has a special significance. As a basic course with strong application characteristics, the ordinary differential equation should highlight the characteristics of application in teaching, cultivate students' ability of innovative thinking, and using knowledge to discovery, analyze and solve actual problems[1].

1. The current situation and insufficiency of ODE course teaching

(1) The teaching content put the emphasis on theory and gives little attention on application. Courses mainly are about teaching theory, lacks teaching case with close contact with the actual reality. The content of the mathematical modeling thought and academic frontiers of knowledge do not full penetration in the teaching. Class teaching often appears as the teacher talks to the students on the front while students listening in the following, such teaching method completely ignored the students' learning enthusiasm, killed students' innovation consciousness and innovation ability. In addition, the survey found that due to the partial differential equation method and the qualitative analysis did not reflect in the teaching content, leading to some specialized and subsequent courses have disjointed phenomenon, a lot of important applicable content with great value was deleted or reduce the requirements.

(2) Simple teaching method, not flexible enough. In classroom teaching, students are in a passive position, as an object of knowledge. Teachers mainly adopt the traditional teaching method with a piece of chalk, a blackboard version, computer, multimedia auxiliary teaching are just used to play the teaching courseware content, ignoring that the classroom teaching should take students as the center actively involved in the classroom interaction with the instructor. In addition, the classroom teaching is faced with hours to reduce conflicts with the teaching content is constant. Teaching content is not reasonable, the processing of some theorem proof process is often very important, but in the interest of time, teachers tend to omit some complicated proof, causes the student to master a little knowledge.

(3) Single evaluation way lacking of comprehensive. The focus of the assessment content or a final exam scores, the common practice of grade calculation, the final question paper grades account for 80%, obviously it is fair, but owing to lack of students' subjective initiative and interest in learning to application, which can lead to a lot of people question paper grade is low; The other 20% overall, attendance, homework completion, and so on and so forth are often come from the inspection. The truth is that attendance can not listen, understand. Although some homework finished, but it is difficult to grasp is truly their own independent, students' practical and innovative ability in the traditional test paper test don't get in. If you continue this kind of test method, it is

difficult to further enhance the students' mathematics accomplishment. So to change this situation becomes more and more urgent.

2.Course reform cultivates students' practice and innovation ability

2.1 Adjust the teaching content and focus on practical application. The target of university education is to cultivate students to integrate theory with practice and the ability to solve actual problems[5]. Ordinary differential equation is the basic course of mathematic course; the content involves the mathematical analysis, the key points in the advanced algebra course the module of ODE can be seen in the following Figure. 1. In addition, a lot of questions in modern subjects such as astronomy, biology, cybernetics, physics, and fluid mechanics can be analyzed and solved with differential equation. For example, one of the giants of the three mathematical Newton uses the powerful mathematical tool- ordinary differential equation to calculate the operation mode for the elliptical orbit planets around stars. In modern control theory, practical system of robotics, inverted pendulum, aircraft and so on while modeling can be concluded into differential system with a control input to ensure the closed-loop system stable operation through the reasonable design of the controller. Accordingly, the solution of the differential system or qualitative analysis process, must with the help of the basic theory and method of the ordinary differential equation. So, as much as possible in the process of teaching to reflect the penetration and application of ordinary differential equations in other disciplines, with the actual problem as the starting point as far as possible to reduce unnecessary red boring theoretical derivation, encourage students to participate in associated with equation of course practice, not only cultivate students' ability to analyze and solve practical problems, but also stimulate the students interest in learning this course. Appropriate cuts theoretical strong in teaching, cumbersome process of theorem proving, adding applied examples and topic, introduce relevant knowledge, in the form of case will mathematical modeling thought into the teaching process. Teacher should put as much actual applied examples in the teaching course to improve the students' enthusiasm and interest in this course such as SIR epidemic model, mechanical vibration of Duffing equation, the pendulum equation, the two body problem in celestial mechanics, electromagnetic oscillation of Vander Pol equation, the population ecology model, the problem of stability of the mathematics and etc.

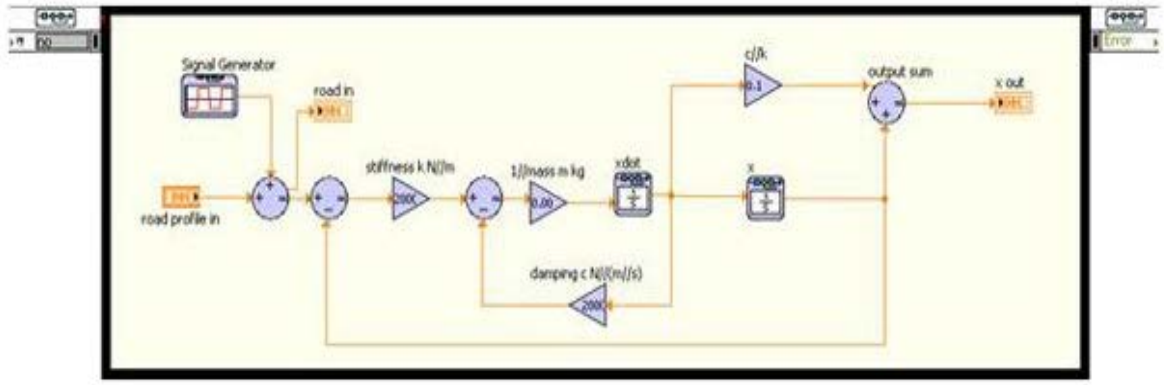

Figure 1: the construction module of ODE

2.2 Change the teaching method, emphasize on ability training. The traditional teaching requirements and teaching plans are based on the abstract "indoctrination" as the main body of knowledge, the final exam with course "pass" as the goal. To really improve students' application of differential equation to cultivate the spirit of science and technology innovation and the ability to solve actual problems requires teacher to complete updating the teaching contents and bring the mathematical modeling thought and scientific innovation thought into classroom teaching research at the same time. The use of mathematical software, students can be liberated from rather time-consuming calculation, at the same time, the mathematical software powerful data analysis, error analysis and graphical display can greatly improve students' interest in learning, improve the

students' ability and scientific computing. In the process of classroom teaching, teachers should pay attention to the use of heuristic teaching method, use the inductive analysis and logical reasoning method combining the interpretation of the basic theory, use simulation method to teach basic scientific research method and to explore the problem, choose some appropriate teaching contents to self-study guide, or use class discussion or decorate extracurricular raise questions through which can make students actively participate in classroom teaching, not only arouse the enthusiasm of the students' learning, but also cultivate the students' ability to analyze and solve the problem of creative thinking. An important aspect of the reform of ordinary differential equations teaching mode is how to enrich the content, carry on the reasonable material handling, guide the student to study in the right way and raise the creation ability and innovation ability. This article will organically combine every link of teaching content, teaching method, examination way to form a new teaching system, thus to carry out the research study, develop the ability of unite theory with practice and practice innovation for students in a positive way, effectively improves the teaching quality.

3. Layered teaching cultivates students' innovation ability

So-called " layered teaching" refers to set out teaching goals of different levels, choose different teaching contents, adopt corresponding teaching methods in accordance with the requirements of teaching outline for students to make students achieve their goals of different levels, to improve the quality of the students in an all-round way[2]. At present, the layered teaching mode has become an effective way to optimize a single class teaching system of teaching.

3.1 Teaching according to their aptitude, arousing students' innovation consciousness. Aptitude is the essence of layered teaching on the basis of students' individual character, such as knowledge structure, psychological tendency, and psychological characteristics to carrying out stratification teaching in teaching methods, teaching contents and teaching means to cultivate students' innovative ability. The purpose of changing teaching methods, strengthen the training of students and training first, ramming double-base remains the primary task in each level teaching, also is the key link of cultivating creative talents, secondly, in stratification teaching focus on the research of teaching methods, based on what they have learned, embarks from the actual background and practical problems for different levels of students with different levels of problem situation, maximum limit arouse the enthusiasm of students to find and solve problems. In addition, the differential equation is a widely applied mathematics courses, to penetrate mathematical modeling thought into the teaching process, combined with the practical application of the latest to learn new knowledge, and cultivate students' innovative ability, an effective way to improve students' ability. The reform of the teaching content to update teaching content, reasonable arrangement of course content, is an important component of the layered teaching mode, teaching material is a knowledge carrier of teaching contents and teaching methods, teachers impart knowledge to students and student learning courses system, access to knowledge tools, reform the teaching content is to improve the quality of teaching, the basic guarantee of training innovative talents.

3.2 Layered evaluation, stimulate students' learning potential. Layered evaluation is aimed at all kinds of students' learning level, making a realistic and appropriate evaluation and affirmation for each student to stimulate students' learning potential, the effect of which cannot be ignored, sometimes even plays a decisive role. So the layered evaluation is an important content of the teaching method reform. [3] Any act without receiving approval or successful experience can't insist for a long time, so teachers should give corresponding approval to different levels of students to let them fully experience the joy of success, which is an important power to stimulate students learning potential.

3.3 Effect of layered education is obvious. From the view of teaching, teachers understand students' learning situation in time according to their aptitude, and then further improve the teaching quality. From the perspective of stratification teaching mode of ordinary differential equations to improve the students' learning efficiency, nearly 3 years course results show that the course exam

pass rate has improved stability. At the same time, the teaching mode and fully mobilize the students' learning interest and ability, to develop the students' ability of independent thinking and innovative ability plays an important role. In the ordinary differential equations stratification teaching mode to set up the students' innovation consciousness, cultivate the students' innovation ability is a long-term and arduous task, need to teachers and students work together. Must conform to the development of The Times, from set out actually, change the traditional teaching ideas and teaching methods, constantly updating the teaching contents, cultivating high-quality innovative talents contribute to the nation.

4.The meaning of ODE teaching

Firstly, specific question is analyzed according to different situations, which is one of the basic ideas of materialist dialectics to solve the problem. As is known to all that the solution of different types of equations is different in differential equation, and the same type equation may also have a variety of solutions. For a given equation, how to choose a simple method to solve quickly is what the student should think seriously.

Secondly, teachers cultivate students to look at the problem in multiple perspectives, the ability of to reveal the essence from different angles in the material world that complicated things appearance also varied, colorful. To reveal the essence from the phenomenon, it is the important issue that people should always focus on[3]. In the teaching, using different types of equations as the typical problems in-depth explanation or let students brainstorming to solve it is very meaningful, take the equation belonging to three different types as examples to students that can use three methods to solve[6]. Comparing the solving process we know that the three solutions each has distinguishing feature, difficult to evaluate. Actually, to determine the type of the equation is the process to look at the equation from the three different perspectives, and the three kinds of method to obtain the equations of process from different angles. It reveals that the three kinds of method to solve the equation is the process to get the answer from different angles. Although the subject itself is simple, training students to solve more problems, more deeply understanding the essence of the problem through different angles are good. T here are many similar examples that they can fully inspire students' thinking, to cultivate students to look at questions in more perspectives and the ability to solve problems.

Thirdly, to cultivate students’ ability to grasp main contradictions, keep complicated things becoming brief and use simple way to solve problems are the force to enforce the development, are the basic characteristics of motion law of the material. Seize the principal contradiction things, ignore the second contradiction, is the basic method to solve the problem. Differential equation is a subject closely linked to nature, science and the production practice. To use differential equation to simulate the movement of material in the complex practical problems requires people to seize the main contradiction of things, ignore the details of the second to change numerous for brief, thus to establish practical mathematical model.

The last but not the least, training students' ability of inductive and deductive thinking is the important thought to solve problems for people. In differential equation, some valuable conclusions are made on the problem of induction and deduction. Therefore, it is important to cultivate students’ thinking ability in this respect, deepen students' understanding of inductive and deductive method and attention in the teaching will certainly to raise their ability of analysis.

5. Summary

The cultivation of student's ability in the teaching of the ordinary differential equation is not restricted to the above four aspects, the author aims to put forward the idea and look forward. In a word, the teacher should make the training students’ ability as a main line to organize differential equation of class teaching. In the teaching, teachers need to not only make the students master the basic concept of the subject and the basic solving method, but also improve students' ability of analysis and problem solving as well as the innovation ability under the background of the

characteristic of this discipline, set the goal of teaching students the specific knowledge, methods and skills, and the ultimate goal to cultivate students' ability and improvement, constantly improve the quality of teaching to receive the best teaching effect.

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