

Exploring the Openness and Innovation of Experiment Teaching in College Mathematics

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Experiment teaching is an important part for science and engineering colleges, teaching through different pilot projects: First, help students to consolidate the theory of operation; second, trail students the capacity and the ability to solve practical problems. Improve students the curriculum of learning, and promote the formation of students to discover and solve the problem. of the basic quality in training students hands-on ability and ability to innovate, while guiding them to develop the attitude of scientific truth-seeking, the style of rigorous and thorough and the spirit of unity and coordination.

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0. INTRODUCTION

There pointed out clearly in “The decision of deepen the reform of the educational and promote competence-oriented education in an all-round way” of CPC Central Committee and State Council’s: “the implementation of quality education to cultivate the innovation spirit and the practice ability of the students” “higher education should focuses on cultivating students creative ability, practice capacity and ability of entrepreneurial” and called for “strengthen the comprehensive and practical curriculum, emphasis on experimental teaching, develop students practical ability” (Zhu, Li & Xie, 200?). All innovations are derived from the practice, tested in actual practice, and apply it to practice ultimately. The reform of our education reform, beginning with experimental teaching staff, changes in the guiding ideology of the teaching experiment, adjusting the experimental teaching system, structure, content and evaluation methods to construct consistent with quality education and talent development open to experiment and innovate new models of teaching and laboratory teaching management the new system, after a series of reforms and the practice has achieved initial results as the world has entered the new century.

At present, many universities have set up a mathematical experiment in China (Wang, Zhao, Zhou & Tian, 2003) built the mathematics experiment course system of their school (Zhu, Li & Xie, 200?) carried out a practical of mathematics experimental course in their school (Fu, Deng & Wu, 2007) proposed open-ended mathematics experimental teaching model, enriching the university mathematics experimental. There have not yet detailed introduction about how to carry out the open and innovative mathematical experiments currently, this paper presents a mathematical experiments model of the three level education system to carry out open-ended mathematics experiments.

1. EXPERIMENT OF COLLEGE MATHEMATICS

1.1. Present Situation on Experiment Teaching Pattern

At present, mathematics experiments opened for non-mathematics includes basic course experiment and mathematical modeling experiments in universities. Mathematics Curriculum Experiment attached to theory teaching is based on the theory of teaching content for the demonstration, validation experiments as the main content of the closed experimental teaching model, primarily as a wealth of teaching methods to stimulate student interest and train our students to master mathematical software used the role of basic skills. The mathematical modeling experiments set up for few students, and carry

with training or elective courses usually, Emphasize on cultivating and improving students' mathematical modeling capabilities and solving abilities. The outstanding problem of these two widely used models of experimental teaching of mathematics existing in universities as listed below

1) Lack of interesting

Validation experiments are to enable students to experimentally verify the correctness of the conclusions is known to experiment. Computational experiments is that many mathematical problems can be expressed in mathematical statement holds, and some can be hand-counted, and some hand be very difficult, and you can experiment by means of mathematical package to complete this time.

The validation experiments and computational experiments are so simple and the use of mathematical software, with repetitive and monotonous nature of does not need mindless and too much thinking that students just interested in the first time. They did not give self-exploration and self-play space to students because of process and methods of experimental with pre-qualification, that not conducive to stimulate student creativity.

2) Lack of practicality

At present mathematical experiment has just begun, is still in an exploring stage. Does the mathematics experiment for a purpose of do math experiments in many schools, and does it usually follow the contents and the steps from books, so it lacks practicality. Effective math experiment should be combined with professional and application and real-life. "One the main responsibility of education is to ensure that students interest in acquiring useful knowledge" [Jiang Wen-ling (Journal of Mathematics Education)]

3) Lack of creativity

Mathematical experiment is a teaching method with open and based on effective learning to students. The students through the cooperation of the discussions and hands-on math test, there not have ready-made answers and fixed method and specific reference books and tools. The students are simply project the book on to do it currently which lacks of creativity that not conducive fulfilling its functions to mathematical experiment.

4) Lack of professionalism

The contents of the current mathematical experiment design did not fully consider the needs of students in the professional (Fu, Deng, & Wu, 2007) knowledge accumulation, training goals and interests and hobbies, and other aspects of personal requirements, that

not conducive to fully mobilize the student self-learning initiative and creativity and the organic integrate of the mathematical experiments and the professional learning of scientific research activities.

1.2. Purpose and Importance of Open Mathematical Experiment

To establish a open and pluralistic new experimental teaching system which fowling on student-centered teaching, and demand-orienting by student-professional nature, hobbies and development objectives, the reform goals of currently experimental college mathematics curriculum are build a more broad-based platform which improve the practical hands-on capabilities and deliver innovation of their potential for the majority of the students.

Mathematics test is to break open the foundations of mathematics within the limitations of discipline, student professionalism, ability, love for the demand-driven, using a student-based multi-level, multi-category, multi-stage open teaching models, and strengthen math test experiment and the professional the organic integration, set up mathematical theory methods and learning, research and practical application as a bridge between the community, in the practical application of mathematics to stimulate innovation and potential students to cultivate the spirit of innovation to enhance practical ability. Compared with the experiment with the basic courses, mathematics, the contents of an open Experiment pay more attention to the application of experimental research and teaching mode of openness; training, compared with the mathematical modeling, mathematics, experimental focus more on opening up professional needs of students and self-design and self-development individual requirements, but also pay more attention to interdisciplinary experimental resources sharing and cooperation in scientific research.

2. RECONSIDERATION OF OPEN TEACHING PRACTICE FOR MATHEMATICAL EXPERIMENT

Mathematical experiment should be to build three level educational system, which contains math experiments with simple, repetitive and feasible number of experiments with a focus on training and strengthening of operational skills test in first level and some experiment contents of basic concepts, basic principles and natures of math with the focus on train students in mathematical methods and general analysis of problems in second level and the experiment contents of the design, synthesis and innovation in third level, that evolve a basic, comprehensive, design of experiment teaching system.

Our school divided the experiment into “test experiments, integrated experimental and design experiments” according to the mathematical basis of the students and awareness

levels of their since 2003. First level education will be set up three “test” of experiments in upper and lower education in the freshman year which to validate the advanced mathematics courses in the main content. Such as the use of mathematical packages for plot functions images, calculate the limit, derivative, integral evaluation, etc. in the second year on the period by 6 “test Sex and computational” experiments to validate the linear algebra and probability and statistics courses in the main content. Such as the use of math software packages for solving linear equations, finding matrix eigenvalues and eigenvectors, random simulation, statistical analysis.

Secondary education will set up 4–5 “comprehensive experiments” in the next issue of sophomore which covers the basic contents of multivariate statistical analysis, optimization theory and numerical calculation of engineering mathematics to verify the main elements of the course. Experience with the mathematical theory of the basic idea and typical methods and deepen their understanding of abstract concepts in perceptual theory and application of relevant skills through observed mathematical phenomena careful, such as the display of sine function of the power series; train students’ sensitivity of observe the problem and consider issues in a comprehensive deal and flexibility of issue problem by carry out exploratory and discovery of research, such as the equitable distribution of seats, arranging schedule problems.

Tertiary education will open 3–4 “design” experiments in the junior, which develop students ability of integrated use of mathematical knowledge to solve problems through abstract and simplify, modeling, solving and analytical testing the practical problems. “Design” experiments focused on the professional needs of students, such as forecasts of oil demand, oil transportation optimization model to assess the equipment protection ability.

First, study and formulate the experimental teaching program for three level education systems. The schemes of teaching need different levels and accord to the respective stages of development because of there have multi-levels and multi-phases in three level educational experiments system, in order to highlight the various aspects of teaching guidelines and training objectives, reasonable arrangements for the various stages of convergence and the transition, so that students be free to choose what they need. At the same time focusing on the teaching plan dynamically adjusted to suit the needs of specific situations to ensure the purpose of opening up the implementation of the teaching experiment. For the freshman undergraduate students, as only the study of higher mathematics, they want to use advanced mathematics to solve different practical problems because understanding for knowledge is different. The first phase requires that they can familiar with the software of mathematical calculations and verify mathematical conclusion, the second phase requires that they can solve some simple little practical issues and practice their own programming, enhance their interest in learning

mathematics; students who the basis of mathematics is good have higher and enthusiasm interesting in learning math, they will take the initiative to do programming exercises, but may be do not know way, teachers can guide and organize them into a discussion group to build a discussions class at this time.

Second, The core and research priorities of the three level Experimental Education System project is that design and layout of experiment content suitable for an open experimental platform and stimulate the creative of teachers and students. In the experimental arrangement of the contents of the compound from the training needs of personnel, the aim is to achieve wide coverage, focused, strong and content of the novel applications. Experimental education system covering the higher mathematics, linear algebra, probability and statistics and other math-based courses, involving elementary number theory, diversity statistics, experimental design, Chaos and Fractals, data mining and so on, breaking within the limitations of mathematical disciplines at the same time, condensing out of new content, reflecting the frontier topics of the development of innovative experiments from the professional scientific research and development. Increase the comprehensive, open and innovative experiment teaching to adapt to the basic needs of different students in different stages of learning and employment and development, reflecting the balance and comprehensive of structure of experimental teaching, the selectivity and flexibility of the experiment content subjects, broad and exploratory of experimental goals, scientific and rigorous of experimental process, the random and discrete of experiments phenomenon, uncertainty and regularity of the experimental results. It stimulate and promote the student's creative thinking and hands-on ability to upgrade following by the numerical calculation to the computer simulation and then to computer intelligent layers of depth. Open experiment mainly consists of four steps in turn: basic experimental, comprehensive experimental, application and research-oriented experimental and papers of designed curriculum. The experiment content needs to improve and update appropriately according to the specific circumstances of teaching.

Third, the organization and management of three level experimental educational system require that experiment experimental teaching need to use curricular and extra-curricular experiments methods, arrange the time and do not arrange joined, doing experiments in the lab and not in combined, united designated pilot projects and experimental projects with a choice, guided by teachers or students discussed on their own combination, which will be an entirely new experience and challenges for teachers and students who are accustomed to centralized management of teaching. Student-centered, problem-pilot, according to actual requirements, should be taken to a variety of flexible teaching forms of organization, students can fully mobilize the enthusiasm and stimulate them to create self-awareness by explore and practice.

Fourth, a student-centered teaching objectives. Three level experimental education

pushed students into the main body in the experiments. In the process of experiment teaching, the experimental subjects chose by students themselves and experimental teachers only provide the experimental data to the students. This approach can give full play to their scientific way of thinking and scientific predictability, enhance students' initiative, participation and creativity, promote students to love thinking, active participation and willing to explore, labor concept of working hard, cultivate the scientific quality of students' identify problems, analyze issues and solve problems and the capabilities of communication and collaboration. Emphasize on learning outcomes, at the same time pay more attention to learning motivation, processes and methods.

3. THE EFFECT OF OPEN MATHEMATICAL EXPERIMENT

1. Improving significantly comprehensive application ability of our students.

It combined mathematical knowledge with solution practical problems, enhance students' motivation to learn mathematics and creativity to solve practical problems and strengthen the awareness of mathematical applications through experimental teaching system of tertiary education. It trained students thought the application of mathematics to enable students to be more proactive thinking, active, rigorous and train the students' ability to express through the open-ended mathematics test. Students participated in and got a good achievement since 2005, received three first prizes, five second prizes and nine division prizes in the National Mathematical Contest in Modeling in last three years, won the national outstanding papers of National College Students Mathematical Contest in modeling in 2009, which published on "Journal of Engineering Mathematics." Students will participate in more and more mathematical modeling activities which is growing their awareness of innovation and applications in math.

2. Improving significantly research ability of our students.

It strengthened scientific research ability of students significantly through experimental teaching system of tertiary education. We guide undergraduate students to participate in School "realistic Cup" competition and awarded the first prize of three papers which named "the security settings of security system" "reorder matrix to seek the best H circle" and "the development of new-type rural cooperative medical research", got the second prize of two papers of "while two successive Amendment Act, seeking the realization of the best H circle process" and "China's rural credit cooperatives, loan pricing model analysis" in last two years, received two first prizes three second prizes of excellent thesis; Students participate in School Web Design Competition Design

Competition actively and enthusiastically and procedures to improve the design capabilities, and make good works. There are a number of undergraduate students in school can be published academic thesis under the guidance, for example, Chen Zhenjie who come from information and computer science of 04 classes undergraduate published a thesis named “matrix of re-seeking the best H circle” on Logistics Engineering in 2007

3. Improving significantly self-learning ability of our students.

It improved students' self-study active highly and grow the ability of self-learning through experimental teaching system of tertiary education. In particular, the teaching of mathematical modeling make many of them to reflect that the mathematical modeling of the training is no longer simply a mathematical calculation but a real tool to solve practical problems in social practice. Through access to large amounts of data, so that they come into contact with many other disciplines of knowledge, inspired the desire for knowledge, but also exercise of computer application ability, expand their knowledge, using mathematical methods to solve practical problems, in the group to discuss and learn about cooperation and compromise, know the importance of cooperation. Through modeling training to enable them to fully apply the knowledge learned to real life, expand the mind.

4. Strengthening continuously practical ability of teachers.

The reform of teaching of the teachers had been promoted through by experimental system of tertiary education teaching. Teaching content is no longer all being laid down in advance and much of the content need to look for materials and discussion to complete. The teaching reform of teachers has achieved good results through several years of teaching practice. The major education reforms were published 14 papers, of which one paper in an interdisciplinary journal and 5 papers in the core journals in the last three years. They won the excellence achievements awards for college teaching and research in General Logistics Department, published a characteristics of materials of the third edition of “Mathematical Modeling and Mathematical Experiment” (Higher Education Press) in 2008, is responsible for the research project of “application-oriented engineering specialty Training Mathematical Modeling and Mathematics Teaching Reform Experiment Curriculum and Teaching Resources Construction”, has been in the sub-topic project of higher education research center Eleventh Five-Year Plan “China's university training model applied research” (Project Number FIB070335-A2-17, key projects). “The research and practice of apply math ability and innovative ability for students” research project has been listed as key projects of education and management classes in Chongqing City.

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