CSCanada
Higher Education of Nature Science
Vol. 1, No. 1, 2011, pp. 7-9
DOI:10.3968/j.hens.1927026720110101.116

ISSN 1927-0259 [Print]
ISSN 1927-0267 [Online]
www.cscanada.net
www.cscanada.org

In Calculus Teaching Students How to Cultivate Creative Thinking

ZHAO Di[1]; LI Hongyi[1,*]; Song zhi Xiang[1]

[1]LMIB, School of Mathematics and System Science, Beihang University, Beijing, 100191, China.
[*]Corresponding author.
Email: Hyl6980@sina.com

Received 25 June 2011; accepted 29 July 2011

Abstract

As a basic course, calculus is playing an increasingly important role. Mathematics teaching of university should pay attention to calculus teaching, combined teaching content with teaching practice to promote student intellectual level to overcome the shortcomings of thinking, to develop creative thinking skills.

Key words: Calculus teaching creative thinking

Zhao Di, Hongyi Li, Song zhi Xiang (2011). In Calculus Teaching Students How to Cultivate Creative Thinking. *Higher Education of Nature Science, 1*(1), 7-9. Available from: URL: http://www.cscanada.net/index.php/hens/article/view/j.hens.j.hens.1927026720110101.116
DOI: http://dx.doi.org/10.3968/j.hens.1927026720110101.116

INTRODUCTION

In the 21st century, as one of the basic course of higher learning calculus plays an increasingly important role in many eras and disciplines. By studying calculus, students would gain the necessary mathematical skills with a certain mathematical literacy, and lay the foundation for further study. Focus on teaching quality in education of mathematics is necessary, because the rigorous mathematical training will not only cultivate the students' rapid response and logical reasoning ability, but also help them develop creative thinking.

Famous mathematician F. Klein pointed out that the usual mathematics textbooks can easily bring the impression: mathematicians are almost taken for granted from the theorems to theorems, and mathematicians can overcome any difficulty. Mathematical knowledge through the temper has become a foregone conclusion; students are submerged in the clusters of the formula derivation and theorem proving makes them almost losing the ability to innovate. In most people's mind that mathematics is an abstract, boring, complicated subject, and math teaching also struggle with math exercise's ever-changing, limited to the "sea tactics", which leads mathematics teaching become a overwhelmed problem-solving mathematics. It's direct result it that many students lose interest in learning,and learning objectives are not clear, having relatively poor sense of self-study and many other problems, mainly reflected in the following areas[3]:

(1) Learning objectives is not clear.
(2) Learn calculus in the inefficient state.
(3) Learning methods are simple, lack of creativity.
(4) Learing initiative and independence is not enough.
(5) Summary of the learning process does not focus on improving.
(6) Limited ability to use knowledge.
(7) Undue reliance on teachers.

The main objective of today's teaching is to develop students' creativity, with high-quality personnel. Student-centered teaching and learning process should attach great importance to innovation ability. This will require that mathematics teachers in the teaching process, to use a variety of teaching methods to enable students to develop creative thinking and habits, focusing on students ability of innovate.

Mathematical Ability of Creative Thinking

Mathematics is a creative activity, a culture of people's thinking, many laws and economics students are also required to learn calculus is powerful proof. It is not only conducive to the development of logical thinking, but also be beneficial to improving creativity. Mathematical innovative thinking mainly contains three aspects[2]: the

Copyright © Canadian Research & Development Center of Sciences and Cultures

courage and ability to explore is the basic premise, and induction, analogy, specialization are powerful tool to explore issues; divergent thinking ability is the core ability to innovate, whose main feature is a sensitivity, fluency, flexibility, and originality; Besides, intuitive thinking is also important to creative thinking.

Nowadays the emphasis is quality education and innovative ability do not need problem-solving master trained by the "sea tactics", but talents with high quality of exploring, discovering and mining based on the learned knowledge. So cultivating students innovative thinking and creativity by teaching mathematics is of great importance, allowing students willing to think, dare to doubt, observe thoroughly, trigger quickly, know extensively, pursue perfection, win through discovery and innovation.

Therefore, cultivation of creativity should be based on mathematics teaching with steady progress.

This requires that mathematics teachers have a high mathematical literacy in teaching the use of various means, continuously guide the students' creative thinking, so that students master the basic mathematical knowledge, dig deeper knowledge based on the basic mathematical knowledge, seeing the nature through the phenomenon of the problem, then understand knowledge thorough and profound, apply knowledge, show their ability to innovate.

Cultivation of Innovative Ability

The key to develop students' awareness of innovation and practical ability is the teacher and the course. It is important that teachers trigger students' sense of self-learning by different means in all aspects of teaching mathematics, and open fertile ground for creative thinking of students. Therefore, teaching methods and teaching methods to develop students' ability to innovate is essential.

1. Simplify, to Stimulate Student Interest in Learning

Mathematics, especially calculus, is always famous for, which makes many students feel very difficult, or even lose interest in learning, gradually be weary of mathematics. The "Interest is the best teacher". If there is no interest in learning, let alone the development of mathematical quality. Therefore, in the teaching of mathematics teachers should focus on improving students' interest and motivation. The level of a teachers decided by whether he can simplify complex issue and visualize the abstract theory, rather than the knowing of mathematical formula and how perfect the theorem's proof is, so that the students can readily accepted an accurate understanding. For example, the Earth's surface is a sphere, but why we usually see a flat one? In fact, this is the replacement of curve by straight. Small on the surface can be considered as a local plane, a small curvature of the curve can also be considered to be a straight line. This gave the students a specific space for imagination, so that they can apply the knowledge to explain some phenomena of life, not only deepened the understanding of the knowledge, but also led to interest in mathematics. Another example, "continuity" concept has been a difficulty inthe teaching of calculu, we can first give "continuous flowing river", "the day the temperature of the continuous change" and other familiar examples of life, and these examples give our impression of continuity, and their essential are characteristics common, isn't it? It is not difficult to find that they are involved in two variables: one time, another object is observed change. The shorter observation time, the smaller the observed object changes is, then the given "continuity" is defined. So that the students can easily understand it, feeling that math is with me, not so abstract.

2. The Introduction of the History of Mathematics, to Stimulate Interest in Learning

A good start can seize the attention of students, arouse the curiosity of students. Calculus teaching is a challenge to students and teachers. For calculus entered the modern mathematics from elementary calculus, the key steps is leading to infinitesimal and infinite limits. Now most of calculus textbooks describe the axioms, definitions, theorems, and proof of strict logic system, while ignore the part of history of concepts' and theories' interesting formation process, resulting in boring calculus. If at the first, a brief history about the development of calculus is provided, you can progressively introduce it from image to abstraction to help students to understand the emergence of mathematical thinking and development process, to stimulate student interest in learning. The introduction of the history of mathematics will deep the students understanding of the discipline itself, even various mathematical ideas through the background and purpose of understanding and the students awareness and understanding of mathematical ideas. We know that many mathematical ideas to solve some practical problems are arising, so that through the history of mathematics learning, students can know some specific practical application of mathematical ideas and prospects can enhance students' ability to apply knowledge.

3. Cultivate Creative Thinking in Mathematics

The core of creative thinking and innovation include analog thinking, divergent thinking, reverse thinking, intuitive thinking, etc[1]. In college mathematics teaching and learning process, students should be guided primarily to think intuitively, inspiring students to use inductive and analogical thinking, promote students to develop divergent thinking, encourage students to reverse thinking. For example, in proving some proposition teachers can observe the results, and analyze, speculate the idea first, and then go to prove. So that the students can make use of induction, analogy and other suspect mathematical thinking (intuitive thinking), to serve the three purposes.

Copyright © Canadian Research & Development Center of Sciences and Cultures

In teaching, you should always use "a given problem", "a problem changing" and other methods to guide students to divergent thinking, and to advocate students to think divergently, also should require students to run their own divergent thinking to solve some of the after-school exercises, to develop good habits of divergent thinking, and the same in teaching to focus on the cultivation of reverse thinking. Some mathematical problems along with the push method is generally difficult to solve when using reverse thinking, the problem can be solved, such as proof of Lagrange mean value theorem, using the definition that limits the number of columns, etc., will not only help students master the knowledge, enlightening the students' thinking differently is more important.

4. Students' Ability to Innovate

In university teaching, it's necessary to train students to dare to practice diligent in their brains. Teacher must allow students to practice by their own hands, students can discover where their weakness come out and need to be strengthen. Problems are identified, problem-solving process; students can play to enhance students' creative thinking and problem-solving abilities. Teachers in the teaching process should appropriately guiding the students to actively practice their ability to innovate. For example, teachers can introduce a subject, and organize a few students to explore and discuss it. In this way, we can create opportunities for students to develop student's personality, to develop their ability to innovate. Students can search through the Internet or books knowledge of related to the topics to, and discuss related issue, put forward their views. These brainstorming processes with collisions of spark will continuously enhance the students understanding of the subject and students' sense of teamwork. It's necessary to share their results with others to achieve greater progress. Of course, teachers can encourage students to actively participate in a number of other practical activities, such as participation in Mathematical Modeling Competition to use their creative thinking to solve some practical problems and practice their creativity.

In short, the full development of high quality innovative spirit and ability of high-level personnel development needs times, to develop students' ability to innovate by of Mathematics teaching is a positive action and responsibility that each teacher should considered.

REFERENCES

[1] Jin Ge, Yali Wang (2006). The Discussions about the Training of Quality of Innovation in Mathematic. *Journal of Harbin Institute of Vocational Technology*, (1)

[2] Baisu Ying, Bing Xia, Kun Li (2009). The Study about the Training of Ability to Innovate in Higher Mathematics. *Journal of Harbin Senior Finance College*, (12).

[3] Wenxin Chen (2009). The Discussions about the Features and Methods of Self-learning in Higher Mathematics. *Journal of Xianning University*, (12).

 Copyright © Canadian Research & Development Center of Sciences and Cultures