

The Development of Mathematics and the Significance of Learning Advanced Mathematics to Broaden the Scope of Mathematical Research

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Abstract: Mathematics is an ancient discipline with a history of at least four or five thousand years. It is the product of many nationalities and regions in the world for generations, and it is gradually formed and developed by people in the production struggle and scientific practice. The original concept and principle of mathematics sprouted in ancient times, and it developed into such a huge system with rich contents, numerous branches and wide applications today. To learn advanced mathematics well, we should recognize its importance, clarify its characteristics, master the differences between advanced mathematics and elementary mathematics, shorten the maladjustment period, and complete the early transition from middle school to university. The emergence and development of mathematics plays a vital role in the development of other science and technology. Mathematics is the foundation of all science and technology, and the development of mathematics is inseparable from the progress of other disciplines. By analyzing the development of mathematics and learning advanced mathematics, this paper discusses how to broaden the scope of mathematics research. In order to better promote the importance and necessity of the interaction between mathematics and other sciences, it is proposed to broaden the research of mathematics to find the application fields that it relate to and promote the development of mathematics.

1. Introduction

Mathematics, in essence, is an activity of generating and solving problems, and the solution of a problem is often the origin of new problems [1]. Mathematicians believe that any problem is solvable, it is only a matter of time. The solution of various problems has time and again promoted the continuous development of mathematics. At the same time, the development of mathematical theory has also accelerated the process of practical research [2]. In the first period of the formation of mathematics, human beings gradually established the concept of natural number, simple calculation method and recognized the most basic and simplest geometric forms from counting. Arithmetic and geometry have not been separated [3]. In human history, this is the initial stage of primitive society and slave society [4]. The achievements of mathematics in this period are represented by the mathematics of Babylon, Egypt and China. French mathematician and scientific philosopher Poincare said that “if you want to meet the future of mathematics, the correct way is to study its history and current situation” [5]. Mathematics is derived from the early production activities of human beings. It has been studied in ancient Greece, ancient Babylon, ancient Egypt, ancient India and ancient China [6]. Mathematics is a science that studies the concepts of quantity, structure, change and spatial model. It is produced by counting, calculating, measuring and observing the shape and motion of objects through the use of abstraction and logical reasoning. We should study the development of mathematics and broaden its research field.

In recent years, the vast majority of all the major breakthroughs in mathematics reflect that many ideas in major disciplines are becoming the same day by day, and various branches are crossing and infiltrating each other [7]. This makes the overall concept of mathematics reappear, and mathematicians in different fields realize again that they are engaged in a common cause. On the other hand, our society is increasingly inseparable from mathematics. It not only provides essential basic knowledge and mathematical methods for students to learn follow-up courses and solve practical problems, but also provides necessary conditions for cultivating students' thinking ability and ability to analyze and solve problems. The teaching content of higher mathematics mainly

consists of two parts: calculus and vector algebra, spatial analytic geometry and infinite series [8]. The major is calculus. In the process of mathematics teaching, teachers should pay attention to students' learning methods, change the previous teaching methods of teachers' indoctrination and students' imitation, and constantly cultivate students' new mode of independent exploration and cooperative learning. The first level of learning mathematics is to connect mathematics with students' daily life, so as to feel the ubiquity of mathematics. The relationship between mathematics and daily life is not limited to the basic mathematical knowledge involved in daily shopping. In fact, there are many phenomena in daily life that are closely related to higher mathematics if you carefully understand them[9]. Advanced mathematics is an important basic subject in science and engineering colleges, and it is also a required mathematics course for students majoring in science and engineering who are not majoring in mathematics [10]. It is of great significance for students to deepen their understanding of mathematics and improve their ability to solve problems by using mathematics to achieve the goal of cultivating talents in higher mathematics.

2. The Development of Mathematics and Learning Advanced Mathematics

2.1 The Development History of Mathematics

With the continuous enrichment of social materials, barter has given birth to the development of commerce, and mathematics has also played a vital role in the economic development of commerce. Commerce has also promoted the development of mathematics, especially the application and operation of natural numbers and fractions. Babylonians and Egyptians had a significant influence on mathematics. During this period, human beings established the most basic mathematical concepts, summed up simple calculation methods, and learned the most basic geometric figures. In this historical period, commodity production was extremely limited, and social practice did not have high requirements for mathematics. Therefore, the concept of number has gradually formed in long-term practice, and people have preliminarily mastered the operation method of number and accumulated some knowledge of geometry. However, this knowledge is fragmented, lacking in system, logical factors and proof of propositions. The development of history has promoted the application of mathematics in various fields of social societies, and these applications have further enriched the development and classification of mathematics. In the Renaissance, the works of great painters were so vivid, precisely because they grasped the basic methods of perspective, which led to the birth of projective geometry. In the 16th century, Europe was in the embryonic stage of the development of capitalism, and the productivity had a great development. The development of productivity urgently required the development of basic disciplines such as mechanics and astronomy, which were deeply dependent on mathematics, thus promoting the development of mathematics. People tend to think that natural science and physical science are easier than mathematics. This is mainly due to the purity of Mathematics (that is, its theoretical nature). The world depicted by natural science and physical science is concrete and people can perceive it. Since the 1960s, the thinking of the mathematical world has been very active, and there have been many new trends of thought -- nonstandard analysis, fuzzy mathematics, catastrophe theory and pansystems theory Nonstandard analysis makes infinitesimal return to the field of numbers, and the basis of calculus has been developed Catastrophe theory makes mathematics develop from the study of continuous variables and smooth processes to the study of discontinuous (catastrophe) processes. The emergence and development of mathematics has its historical inevitability. The emergence of calculus is an unprecedented leap in the history of human scientific civilization.

2.2 On the Learning Methods of Higher Mathematics

After students enter the university, advanced mathematics is the most important and difficult basic theory course they encounter first. Many students are very uncomfortable with the above-mentioned characteristics of classroom teaching. Advanced mathematics review should be thoroughly drilled and thoroughly read. When reviewing, you should have a pen and paper at hand. As some mathematicians have pointed out, "When you study mathematics, you can't just read

books. You must use a pen to help you think.” You should deduce the important formulas in the book and draw some supplementary figures on paper or notebook, which will help you remember the main things. In the new era, the higher mathematics education system pays more attention to the teaching method of infiltrating mathematical modeling thoughts, which is conducive to paying attention to the education of students' mathematical thoughts and thinking, and focuses on cultivating students' mathematical practice innovation. Therefore, in the classroom, teachers should adapt to the role change of the guide as soon as possible, hand over the classroom initiative to students, and encourage students to observe problems, recognize problems and extract key points through mathematical models, so as to find out the correct solution ideas in time. In teaching, teachers should try their best to introduce real-life situations into classroom teaching, and combine lively hot topics to enable students to learn independently. It is necessary for students to cultivate self-study ability, independent thinking ability and thinking ability in universities. For example, when doing some comprehensive exercises, we should be able to connect knowledge in many aspects, attach importance to the analysis and thinking of solving problems, and develop the habit of logical thinking. Before solving problems, we should carefully examine the meaning of the questions, think positively, determine the way to solve problems, and choose the simplest way to solve them. When solving problems, we should write the steps of solving problems as concisely as possible, and pay attention to strengthening argumentation and conceptual problems. Students should be able to grasp the learning methods of higher mathematics preliminarily, stimulate their inner enthusiasm and creativity, and then establish a correct learning view. Besides learning knowledge, students think about the fields that can be used in learning advanced mathematics. The important learning links are shown in Figure 1.

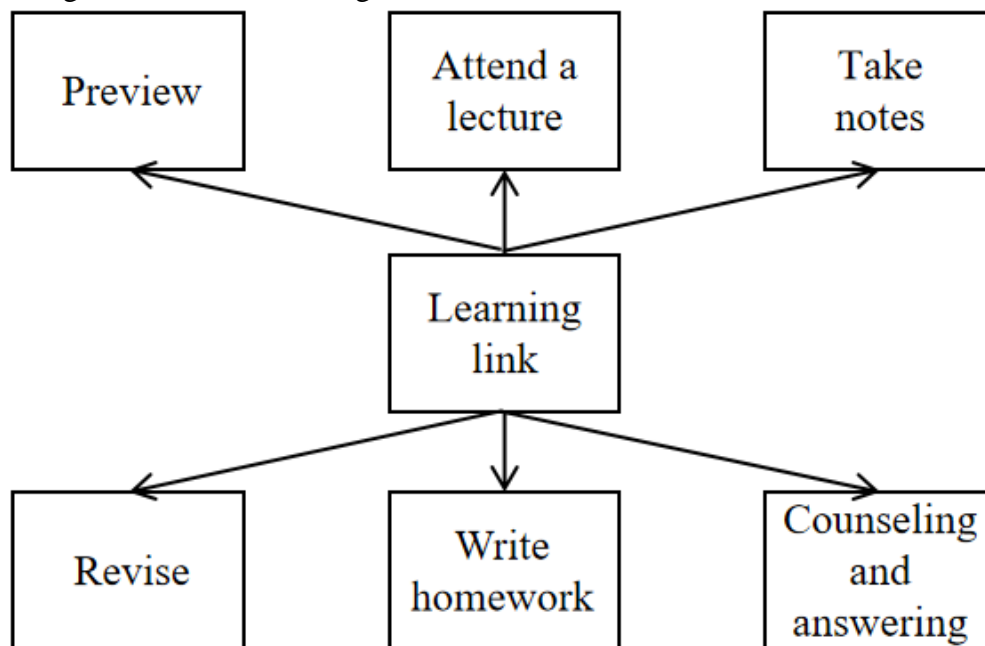


Fig.1 Important Learning Links

3. Broaden Mathematical Research

3.1 Design Exploratory Work to Open Up Innovation Space

In today's scientific field, promoting crossover and application is a very important and difficult task in mathematics. If you want to broaden mathematical research, you must strive to complete the task of advancement. The new curriculum advocates students to actively explore, obtain information, innovate knowledge, and cultivate the ability to analyze and solve problems. We should abandon a misconception, and don't think that reading the topics in math class and reading the contents of textbooks is math reading. This can only be regarded as a teaching link, and it can only guide students to sort out the learning contents and summarize the learning methods, which is

not math reading in the real sense. In homework design, teachers can design some exploratory homework based on students' active exploration, experiment, thinking and cooperation according to the teaching content and students' experience in mathematics activities, so that students can become explorers of a problem in mathematics activities. This kind of homework is impressive and effective. In terms of micro-courses, micro-courses combine mathematics with real life, which can make students realize that mathematics exists not only in textbooks, but also in life, which can greatly stimulate students' interest in learning and enable them to learn mathematics better. At the same time, students will try to combine their mathematics knowledge with their life, which greatly improves their application awareness and ability. For such a basic subject as mathematics, the state provides stable and continuous support mainly through the Natural Science Fund. With the development of economy and the improvement of financial situation, the state's investment in natural science funds has also increased greatly in the past 10 years. . With the support of the state, the major cross-cutting and applied programs promoted by the mathematics community have a solid guarantee foundation. In the near future, as much funds as possible will be specially allocated to support the work aimed at promoting the intersection of mathematics with other disciplines and promoting the application of mathematics. The method of broadening the plane of mathematical thinking is shown in Figure 2.

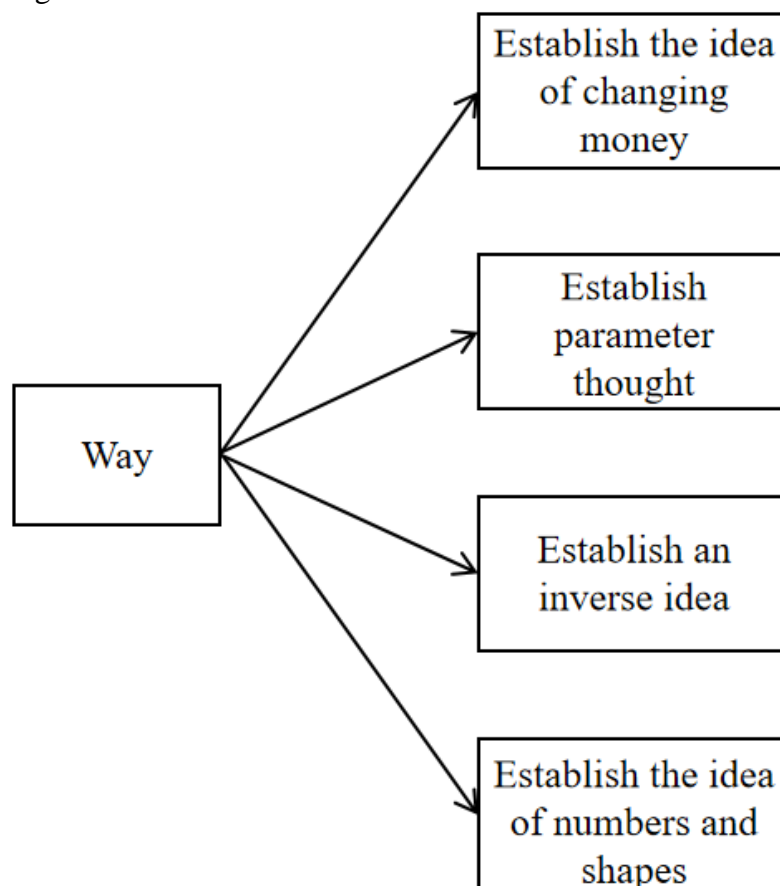


Fig.2 Ways to Broaden the Plane of Mathematical Thinking

3.2 Reflections on the Application Range of Mathematics

Nowadays, the trend of the development of science and technology is that science communicates with each other, crosses and infiltrates. However, because the development of science and technology in China is still relatively backward, and the system is very cumbersome, it is difficult to cross and penetrate. In science and technology, two issues should be paid attention to. First, the current division of disciplines is not conducive to the development of interdisciplinary marginal disciplines. Higher mathematics course is a subject with strong applicability and practicality. The application of knowledge is more important than knowledge itself. Of course, this is a complex problem, which needs more in-depth investigation and learning from mature international practices.

Secondly, the current evaluation system is not conducive to the development of interdisciplinary research. We should establish a scientific evaluation system suitable for China's national conditions on the basis of in-depth research. It needs not only the existing mature mathematical methods to understand and solve the problems in these fields, but also the establishment of new mathematical structures, the development of new mathematical theories, and the search for new mathematical methods to solve these problems. In this way, we not only contribute to solving scientific problems in the real world, but also promote the development of mathematics. Teachers can combine the needs of higher mathematics teaching, collect materials from the internet and life, and create problem situations, and students can explore and learn in groups. In the process of completing the teaching task, students should carefully observe and record the dynamic performance of the group members, so as to ensure their enthusiasm for participating in the activities. At the same time, we should guide and inspire students' problems in the modeling stage, and fully implement the modern educational goal of mathematics teaching. Our country must encourage mathematicians to dare to innovate, abandon old ideas, join in the interdisciplinary field, combine with physics theory and other theories, explore higher and further modern science and high-level mathematical problems, and find the application scope of mathematics.

4. Conclusions

Teaching and learning complement each other. Mathematics teaching is both a science and an art. Mathematics comes from life and is higher than life. It comes from life and returns to life. Therefore, if teachers can teach mathematics behind closed doors, they must break through the barriers of mathematics teaching and learning, make them connect with life and other disciplines, and make students feel the infinite fun of mathematics learning because of the widening of time and space. Mathematics has its important application in the process of widening the emergence and development of mathematics, which promotes or stimulates the continuous and in-depth development of various branches of mathematics. Take the initiative to understand some important cutting-edge scientific issues in these scientific fields, actively find the entry point of intersection and penetration with these fields, and find a place where mathematicians can give full play to their talents. Modern science and technology and production practice will put forward more and more complex new topics to mathematics, which will inevitably produce much more profound mathematical ideas and more powerful mathematical methods. Mathematics will explore and develop to a higher, broader and deeper field, and become a tool and means to analyze and understand various phenomena in the world.

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