

COLLISION BETWEEN MATHEMATICS HISTORY AND HIGH SCHOOL TEACHING FROM HPM PERSPECTIVE

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ABSTRACT

Mathematics is boring under the traditional Chinese education mode, but in fact, the vivid interest of mathematics has not been displayed. As the word HPM appears, more and more people begin to pay attention to the history of mathematics and the value of mathematics teaching. With the deepening of research, the history of mathematics slowly enters the vision of teachers and students. Starting from the history of mathematics, this paper enters the high school mathematics classroom, studies the fusion way of mathematics history knowledge and high school mathematics knowledge in order to hope that students can appreciate the beauty of mathematics.

Keywords: HPM, Mathematics history, Mathematics teaching.

INTRODUCTION

The basic goal of modern basic education is to learn literacy and numeracy, which is also the reason for the most important school hours on Chinese and mathematics from basic education to higher education. Both are the most important in our lives, but mathematics should be more important. Professor Pei Gu once said: a person can live without literacy, but it is difficult to live without knowing the number. In Chinese, for example, different emotions can be expressed through idioms. This is the unique style of Chinese, and the pursuit of mathematics is to solve practical problems. In the new curriculum standards mentioned that we want to learn useful mathematics, mathematics education is to pursue a universal knowledge, to achieve the use of learning. The difference between the two is obvious, these should be through the value of mathematical history to think and understand.

The history of mathematics is to study the origin and development of mathematical concepts, mathematical ideas and mathematical methods, and their connection with social politics, economy and general culture. The history of mathematics is not simply the chronological record of mathematical achievements, it is the process of people's constant exploration of mathematics in the past years, it is the history of the inheritance and development and evolution of mathematical theory, and the relationship with all aspects of society, or the history of the development of mathematical thought. It is impossible to fully understand the mathematics subject without understanding the history of mathematics.

THE IMPORTANCE OF THE HISTORY OF MATHEMATICS PENETRATING INTO HIGH SCHOOL MATHEMATICS TEACHING

At the second international congress of mathematicians HPM, the study of mathematics history and mathematics teaching has become a new academic field. Understanding historical changes is a step in understanding this science. Xingui Zhang believes that studying the history of mathematics makes learners understand the emergence and development of mathematics more deeply, improve the level of scientific education, and obtain the thinking method of exploring

new fields. Professor Xiaoqin Wang describes the value of mathematics from the aspects of mathematical interest and mathematical view, the value of raw materials, the emotional influence of mathematics learning, and the cognitive process of mathematics learning^[1]. At the 8th National Symposium on the History of Mathematics and Mathematics Education, many scholars have a different understanding of this aspect, and have expanded in different aspects of research. Professor Xuhua Sun takes the fractional four principles operation in Nine chapters arithmetic as an example to clearly describe the importance of the combination of mathematics history and mathematics education, and points out that HPM aims at the connection between mathematics education and mathematics history. Discussion on HPM Theory In order to improve students' learning efficiency, teacher Xiaoli Dong explores how ancient mathematics thought can be connected with students' mathematics core accomplishment by taking the maximum common divisor as an example. A popular research in this paper is HPM teaching practice research, teacher Chengxian Lu explained the concept of plural as the content, based on the perspective of HPM to integrate historical knowledge into the classroom, and conducted a questionnaire after class to get students feedback, the survey found that the teaching of the concept of plural based on mathematical history is helpful for students to understand the application value of plural^[2].

The Mathematics Curriculum Standard (Experiment) of General High School (2003 Edition) states : " The Mathematics Curriculum of Senior High School advocates the cultural value of mathematics, and puts forward enough requirements for learning mathematics culture in the appropriate content, and sets up "Selected Notes on the History of Mathematics ". Subsequently, the General High School Mathematics Curriculum Standard (2017 Edition) added to understand the scientific value, application value, cultural value, aesthetic value of mathematics. We can see the importance of our country to the history of mathematics in mathematics teaching through the revision of curriculum standards in the past dynasties.

For teachers, the study of mathematics history not only enriches teachers' mathematics knowledge, but also enriches their knowledge system and plays an important role in improving their teaching literacy. The explanation of the history of mathematics is not to tell several historical stories according to the book, but to integrate historical facts and mathematical knowledge skillfully. This also brings new challenges to teachers' teaching. As the old saying goes , " To teach others a bowl of water, you must have a bucket of water ." That is to say, if we want to pass on the knowledge of mathematics history to the students, we must first learn deeply about it and teach ourselves how to know a little about it. The process of learning mathematics history can cultivate teachers' deeper understanding of mathematics thought, at the same time, it has great personal charm for teachers with knowledge of mathematics history. Under the influence of mathematics history, teachers' teaching methods will be affected. Teachers will understand students better and regard students as a person who can think and explore, which will help to teach students according to their aptitude.

CREATE A CULTURAL ATMOSPHERE AND STIMULATE STUDENTS' ENTHUSIASM FOR LEARNING

Mathematics is a subject that makes everyone sound "scared ", teachers find it difficult to teach, students are more afraid of mathematics, rarely hear people like mathematics. There are some difficulties in mathematics knowledge, plus the influence of students' subjective factors, students will lose interest in mathematics over time. But mathematics is a historic and very cumulative science, mathematics has its own unique charm, mathematics history and teaching can be integrated in the classroom , " cold "knowledge principles, concepts and other forms of

knowledge to the students in a new way. The history of mathematics can not be separated from the story of mathematicians, each mathematical theory is established in the process of inheritance and continuous development, is the result of many mathematicians day and night dedicated research. Each mathematician's way of learning is different, students can find their own learning by understanding the story of mathematicians, after all, the power of example is infinite.

Mathematics is not boring, but is ignored in the teaching process. In the history of mathematics, the branch of mathematics that arises from games often happens. For example, the famous seven-bridge problem is a game. It is typical that the theory of probability was founded because of the dice game, which originated from the study of dice points in gambling games in the European Renaissance, and then the reasonable distribution of gambling books was concerned by such famous scholars as Pacioli, Pascal, Pierre de Fermat and so on. Gambling was involved in the classical works of early probability theory. The integration of mathematics history into teaching not only improves the boring problems in traditional teaching, raises students' interest, but also makes students feel the importance of probability in the historical problems, and can use the knowledge learned reasonably in life.

For example, in middle school, the concept of limit is more difficult to understand, in order to arouse students' interest in learning can introduce an Achilles chasing tortoise story: "Achilles and tortoise race, he after the tortoise, when he ran to the tortoise's starting point, the tortoise has already advanced a distance, so the tortoise is always in front of him, that is, Achilles can never catch the tortoise^[3]." The vivid cultural background of mathematical names is easy to arouse students' interest, and the anecdotes of mathematicians are also very attractive.

THE HISTORY OF MATHEMATICS CAN BE USED TO TRAIN STUDENT'S MATHEMATICAL THINKING

In the high school mathematics teaching mathematics thought method is the most important, it helps the student to master and understand the mathematics knowledge, the student has understood the mathematics thought method, may achieve the use of learning, draws a lesson from one another. Mathematics thought method is the soul of mathematics subject and an important part of mathematics culture. It is mentioned in the new curriculum standard that we should pay attention to the cultivation of mathematics thought method, which can not only improve students' mathematics core accomplishment but also be the key to the formation of students' mathematics ability. To study the history of mathematics is to study the origin and development of mathematical concepts and mathematical thinking methods. In the course of classroom teaching, the method of mathematics thought runs through all the time, but the students' understanding of it is not deep enough and thorough, so in addition to the necessary training of mathematics problem solving, we should also guide the students to refine and master the method of mathematics thought, and feel its cultural atmosphere.

For example, when explaining the knowledge point of plane rectangular coordinate system, the mathematical thought method mainly extracted from this section is the combination of numbers and shapes, and he mainly talks about transforming geometric problems into algebraic problems or algebraic problems into geometric problems. In order to facilitate students to understand this thought method can infiltrate the knowledge of mathematical history. Descartes, a French mathematician, established a coordinate system in the 17th century, which provided a theoretical basis for the subsequent geometric problems by introducing algebra into the study of geometry. Luogeng Hua, a mathematician in our country, first proposed the combination of

numbers and shapes. He mentioned that numbers and shapes are based on each other. This thought student should be very familiar in the middle school study process, but still applies in the high school stage, through the form and the number mutual transformation, causes the space form and the quantity relation organically unifies, simplifies the complex question, this is a process which transforms the unknown into the known, the complex into the simple, plays the important role to the student mathematics thought cultivation and the mathematics accomplishment enhancement.

Mathematics thought method is an important part in the teaching goal of high school mathematics. In order for students to master these contents better, teachers should not only transfer knowledge but also guide students to discover the connection between mathematics culture and real life in the teaching process.

LEARNING THE HISTORY OF MATHEMATICS TO ENHANCE STUDENTS' AESTHETICS

The beauty of mathematics is also a kind of beauty, which reflects the unity of the purpose and regularity of the quantitative relationship and the spatial form, the unity of human sensibility and its own rationality, and its expression way is the aesthetic feeling of mathematics. The aesthetic feeling of mathematics refers to the feeling of beauty caused by feeling the inner essence of a certain object of mathematics. The integration of mathematics beauty in mathematics teaching can make students feel and understand the beauty of mathematics in the process of learning mathematics, through the experience of many mathematical emotional experience, roam in the sea of joy in mathematics, and produce mathematical aesthetics.

People in the past continuous exploration, mathematics began because of people's life needs, but because of the continuous development of productivity, people's ability to transform life is getting higher and higher. From the beginning of counting to the present information network era, people no longer use mathematics because of life needs.

For example, symmetry and harmony is a kind of mathematical beauty, and its essence is the unity of opposites in mathematics. The most basic circle and parabola in geometry have distinct symmetry, which embodies the formal beauty of mathematics. Pascal's theorem: the intersection points of three sets of opposite sides of an ellipse must be collinear. Brianchon theorem: any tangent hexagon of an ellipse, its three sets of lines to the vertex must have a common point. And this is a set of dual theorems which embody the symmetry of theorems in mathematics. Soft round, stable triangle, one after another sinusoidal curve, flat parallel line, in harmony, the combination of static and dynamic just give us beautiful senses, meet people's pursuit of beauty.

For example, a simple beauty of mathematics, but also reflects the intrinsic beauty of mathematics. Mathematical language and mathematical symbols are the most concise and beautiful language in the world, and the abstract conclusions of many complex objective phenomena need to be described by symbols. In mathematics teaching, our most common mathematical language embodies mathematical concepts, theorems, rules and formulas. If the solution of mathematical problems in ordinary language is not only complicated but also lengthy, and the mathematical language speaks mathematics content and meaning in a highly abstract summary, and grasps the mathematical language will understand the impeccable mathematical beauty. For example, the operation of power in high school reflects the beauty of simplicity pursued by mathematics.

Mathematical beauty can also be found everywhere in life, such as learning the golden section from the beginning of the human body structure, our elbow is the golden section of the arm, the golden section of people's height is the navel; in the building the average window width to height ratio is 0.618; also, people feel the most comfortable when the temperature is 23 degrees Celsius, because the temperature to body temperature ratio is 0.618; string instrument sound code at the golden section of the strings playing sound more beautiful^[4]. The knowledge of flexible integration of mathematics history in mathematics teaching will enable students to discover the charm of mathematics itself, will cultivate students' aesthetic ability, and enhance students' ability to discover, feel and appreciate beauty.

THE HISTORY OF MATHEMATICS CAN CONSTRUCT THE COGNITIVE STRUCTURE OF STUDENTS

It is difficult for students to understand the inherent impression of mathematical knowledge, and it is easy to master simple mathematical arithmetic in primary school, but it is difficult for some students with relatively weak mathematical thinking to understand when they come into contact with the law of mathematical concept theorem. According to the knowledge of psychology, we need to understand the students' proximal development area in order to clarify the students' learning ability and then guide the students to learn new knowledge. George polya a mentioned that learning mathematics can only really understand mathematics when it comes to seeing it come into being, following the historical sequence of mathematical development, or doing mathematical discovery in person.

In high school mathematics function teaching can be integrated into the history of mathematics, teachers in the preparation of lessons to find suitable materials for integration of the history of mathematics, combined with classroom content for scene construction, this is not only simply the introduction of situations, but the whole idea throughout the classroom. For example, in the explanation of the concept of function, adding the explanation of the history of mathematics, the German mathematician Leibniz first proposed the term function, originally used to represent the geometric quantity that changes with the curve, and then Bernoulli mentioned the application formula to represent the function. Euler puts forward different views on this, he thinks that if one variable depends on others in one way, the former is called the function of the latter. With the emergence of the concept of set, the change of function becomes more and more rigorous, which is the definition of function in our high school textbook^[5]. By teaching the historical process, students know that the development of the concept of function has gone through many refinements, while introducing historical knowledge, we should also guide students to compare the concept of function in junior high school, so that students can not only clarify the different problems of the concept of function, but also grasp the concept of function more clearly. Students integrate into the cultural atmosphere created by teachers, experience the twists and turns of concept formation, from confusion to joy, deeply understand the concept of function, and then construct their own cognition.

Mathematical concept is the cornerstone of mathematical knowledge, mathematical thinking is the main way for students to solve mathematical problems. Understanding the development and formation of concepts and the thinking of mathematicians helps students to expand their cognitive structure. Students participate in the classroom through the guidance of teachers, internalize the knowledge they have learned, and communicate with their classmates to establish their own knowledge network to achieve our original purpose. As Mr. Hua Luogeng mentioned: not only to bring up the good meal, but also to have the process of cooking. That is, it is better to give fish than to give fish. The theorems of any concept law in mathematics

are not accomplished overnight, they all condense the wisdom of mathematicians. It is imperative to integrate mathematics history knowledge into high school mathematics teaching.

RESULTS

There is no harm in adding history to mathematics teaching. The history of mathematics can create an atmosphere for students, arouse students' enthusiasm for learning, teach students the origin of the development of mathematics, guide students to think independently, be good at discovering the beauty of mathematics around them, construct their own knowledge context, look at the world with mathematical eyes, and love mathematics and love life.

DISCUSSION

The difficulty in learning mathematics is due to the inherent properties of mathematics, namely formalization, strategy and symbolization. The first is that mathematics is the model of research form, and the high abstraction makes it divorced from the concrete model in real life, which makes it difficult for students to accept. The second is that mathematics is the most logical subject, and the way of thinking and strategy needed to solve problems are rigorous. The third is the symbolization of mathematical language, the mathematical language system is huge and abstract. It produces three contradictions in mathematics teaching, namely, realistic background and formal model, strategic wisdom and logical stereotype, symbolic language and thinking level. This problem is also reflected in the integration of mathematics history and mathematics teaching. The simplest problem is how to choose the materials of mathematics history according to the different contents of mathematics classroom, including how to connect them with knowledge reasonably, not to explain the phenomenon that mathematics history knowledge makes copy mechanically.

CONCLUSION

The integration of mathematics history and high school mathematics teaching can not be realized overnight. For normal school students, colleges and universities should not only offer courses in mathematics history, but also let students understand the value of mathematics history and the purpose of this class is not only to learn mathematics knowledge, but also to lay a solid foundation for their future career; For the first-line mathematics teachers, the knowledge of mathematics history is relatively weak, schools should carry out continuing education and training, first to understand the history of mathematics knowledge is the basis, second, teaching methods need teachers to discuss together, express their own views to achieve better teaching results continue to try to make progress in practice to form their own new style of lectures. At this stage, the case of mathematics history in high school textbooks is not enough, and it is expected that the future can be more perfect through the continuous research of many scholars.

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