

Research on mathematical culture

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Abstract: The so-called mathematical culture refers to the views, beliefs, attitudes and methods contained in mathematical knowledge. It pays attention to the rich and profound cultural connotation of mathematics. It combs the long and tortuous development history of mathematics, character stories, rational spirit and humanistic thoughts, sets off each other with mathematical formulas, symbols and theorems, and connects the intellectual and conceptual components of mathematics. It is also helpful to show the charm of mathematics. This paper analyzes the significance of mathematics culture, and probes into the carrier and content of mathematics culture, hoping to provide some useful references for promoting the development of mathematics culture.

Key words: Mathematics culture; Meaning research; Carrier content

The generation mechanism of mathematical culture cannot be separated from the development of social production. It is an important product of human production activities and an important component of human culture. Mathematical culture manifests the laws and thoughts of mathematical discipline, and at the same time covers the unique spiritual values of human culture. By analyzing mathematical culture, we can find another clue to explore mathematics in addition to the clue of mathematical knowledge, reveal the profound cultural charm and cultural connotation contained in mathematics, and guide people to further explore the subject significance of mathematics and carry out value pursuit.

I. Study the significance of mathematics culture

1. Increasing the interest of mathematics and the abstract complexity of narrative

mathematics knowledge is more prominent, especially in mathematics education, many teachers can fully present the mystery and charm of mathematics to researchers, but will be broken down into boring “symbols, formulas, calculations” mechanical solution process, the inherent beauty of mathematics is destroyed. It also affects the researchers’ cognition of mathematics. Digging the cultural connotation contained in mathematics can enhance the story and narrative of mathematics, integrate mathematical knowledge into the deep cultural heritage of mathematics, find the correlation between mathematics and concrete things, connect numbers, mathematical symbols and mathematical formulas with life and production, and put mathematical knowledge points in the whole history of mathematical development to understand. It can further present the charm of mathematics, enable learners to have a more perceptual cognition of mathematics, and increase the interest and narrative of mathematics.

2. Cultivate rational spirit

Mathematics is a discipline that embodies strict logical laws and profound spirit of rational analysis. It serves production and life through precise and thorough numerical and spatial calculation, and taps into the profound connotation of mathematical culture, which is conducive to the cultivation of rational spirit. Mathematics learning activity is not a simple calculation and solution, but a process of training strict logical thinking and cultivating rational spirit. To feel the rational spirit contained in mathematics, we can start from the excavation of mathematical culture, and gradually cultivate learners’ logical thinking ability and rigorous knowledge seeking habit with accurate calculation, careful argumentation and complex formulas, which is the essential significance of integrating mathematical culture teaching.

II. The carrier of mathematics culture

1. The classical mathematical stories contain mathematical culture

Mathematical culture is manifested through the classic stories spread in mathematics, which explain the long and tortuous development history of mathematics and explain the shining personality of mathematicians. Researchers can use the classic mathematical stories as the carrier to dig out the mathematical culture contained in them, sort out the curious stories, carry out humanistic analysis, and understand the development process of mathematical knowledge, mathematical thoughts and methods.

For example, in the history of the study of irrational numbers, there is a story that still leaves people with a lot of emotion, that is the story of Hybersos. Hybersos was a mathematician of the Pythagorean school, but at that time the Pythagorean school believed in the idea that “all things are numbers”. At that time, the study of mathematics was in hot progress, and the Pythagorean school had a profound influence at that time. However, Hybersos’ “diagonal length of a square with sides of one” disproved the conclusion that everything is number. In order to defend the truth and devote his life to the cause of mathematical research, Hybersos wrote the glory of reason and humanity in the development of mathematics at such a heavy price. This story has inspired generations of mathematical researchers, the road to truth is not smooth, and now the truth presented in front of us even requires the pioneers to pay their lives, inspiring countless mathematical researchers to work hard and struggle for the development of mathematics.

Another example is the mathematician Euler was blind, but he studied and learned mathematics with his strong memory and mental arithmetic ability. Under such difficult conditions, he has become one of the greatest mathematicians in the 18th century. The classic stories of mathematics reflect the admirable qualities of mathematicians in scientific research. From the stories of these mathematicians, researchers gradually form the spirit of climbing peaks and daring to innovate. For example, in the growth stories of Newton and Leibniz, the founders

and founders of calculus, you can feel the tortuous road of mathematical development, and feel the spirit of perseverance, seriousness and rigor of mathematicians. By understanding and studying the classic stories of mathematics, we can unconsciously promote the rigorous learning attitude and the spirit of self-improvement. Humanistic stories may inspire future generations to continuously overcome the problems in mathematics and promote the continuous development of mathematics, or bring life inspiration to researchers, making them stronger and more optimistic on the road of life.

2. The mathematical culture is embodied in the mathematical thought and method

Mathematical thoughts often contain profound humanistic philosophy, and they are good at associating mathematical thoughts and methods with life and extending their connotations further, from which more profound philosophy can be found. Cultivating mathematical concept and consciousness with mathematical culture is more helpful for people to discover the universal laws of the world and enhance the profoundness of thought.

In mathematics, there is a “Fermat number”, which is a research result obtained by the mathematician Fermat in 1640, he found that when $n=0,2,3,4$, the value of $2^{2^n}+1$ is prime. He then reasoned on this basis and showed that for all natural numbers n , the formula $2^{2^n}+1$ is prime. It was not until 1732 that the mathematician Euler overturned Fermat’s conclusion. Euler applied the idea of counterproof, showing that when n is equal to 5, the value of $2^{2^n}+1$ is not prime. “Fermat number” shows the importance of the thought of counterproof to mathematical proof, which inspires mathematical researchers to carry out mathematical research with rigorous thinking logic and face mathematics with rational spirit. “Fermat number” is often mentioned in mathematics education. Teachers should cultivate rigorous thinking and counter-proof consciousness through Fermat number education. The mathematical knowledge embodies the rigorous logical thinking of mathematics and the most general philosophical wisdom. Bohr, a famous French mathematician, once supported the relationship between mathematics and philosophy, saying that the two promote each other, and pointed out that mathematics contains beautiful philosophy, and people can find many laws through mathematics. From this, we can also find the close relationship between mathematics and philosophy.

Looking at mathematics from the philosophical point of view, we can find that mathematical methods and mathematical thoughts also contain rich philosophical principles. For example, from the analysis of limit thought and the definition of definite integral, we can glimpse the idea of development and find the contradictory view of the unity of opposites. The concepts of definite integral, double integral, curve integral and surface integral are all strictly defined by the four steps of “division, approximation, summation and limit”, which correspond to the methods of “reducing the whole to zero, invariable substitution, integrating zero into whole and infinitely dividing” in mathematics. These four methods are examined from the perspective of philosophy. It can be found that it contains the dialectical materialist worldview of unity of opposites and quantitative change to qualitative change. In calculus, an area is divided into infinite small trapezoids, reflecting the relationship between qualitative change and quantitative change; Take the infinitesimal part of the area of the approximate value of the summary, instead of the area of the region, embodies the negation of the negation law and the law of unity of opposites. Applying the philosophical principles contained in mathematical thought to guide life is helpful for researchers to discover the general methods of mathematical research and to set up Marx’s dialectical materialist world view.

3. The classical examples of mathematics carry mathematical culture

There are many classic problems in the history of mathematical development. When exploring these famous mathematical problems, researchers can go through the long river of time, find the seeds of mathematics quietly incubated in the ancient, analyze the thinking logic of mathematics, and have a clearer understanding of the development history of mathematics. Gently brush the dust of history, uncover the veil of history, we can be surprised to find the number symbols engraved on ancient artifacts, and find the trace of mathematics. These mathematical classics seem to be the messengers of time, conveying ancient wisdom and outlining the development course of mathematics.

For example, the Nine Chapters on Mathematics in ancient China gives many famous titles, in which you can find Zhao Shuang’s circular square drawing and find the wisdom of the ancients in mathematical research. By analyzing these famous titles in the history of mathematics, you can not only find the fun of studying mathematics, but also have a deeper understanding of the history of the development of ancient mathematics in China, and broaden the vision of mathematics. Ancient mathematicians created an algorithm called “surplus and deficiency technique”, which still plays a role in the field of solving approximations for high-order numerical equations in higher mathematics. The analysis of mathematical classic examples enables researchers to have a deeper understanding of mathematical culture and its development.

There are many examples about the application of mathematics in ancient Chinese traditional culture, such as sundial to judge time, hourglass timing and so on. It is of great significance for researchers to develop innovative thinking and cultivate cultural pride to feel the ancient people’s mathematical wisdom and learn the splendid Chinese civilization through various mathematical practice activities. “Practice is the only criterion for testing truth”. In practice, researchers apply and verify knowledge, gradually strengthen their logical reasoning ability, and abstract mathematical problems become vivid in practice. The 5,000-year civilization of the Chinese nation is world-famous, and mathematics is one of its brilliant colors, which has produced many excellent mathematicians and a large number of mathematical masterpieces. Before the 14th century, Chinese mathematics was at the forefront of the world, representing the highest level of people’s understanding of mathematics at that time. Let the researchers of mathematical culture, reading China’s ancient mathematical masterpieces, such as “Zhou Suan Jing” “nine chapters arithmetic”, not only can make them deepen the cognition of mathematics, but also help them to develop respect for national history, love national culture emotional attitude, so that they form a sense of national pride.

4. The accumulation of mathematical culture in the history of mathematical development

Exploring the history of mathematics development at home and abroad, we can dig out the rich cultural connotation and humanistic

charm, which can arouse the enthusiasm of researchers and the desire to learn. Like the development history of other scientific fields, the development of mathematics is long and tortuous. Mathematicians can guess mathematical definitions, formulas and theorems after countless studies and verification. Calculus, an important component of today's higher mathematics, originated in more than 400 BC, until the early 19th century to establish a set of rigorous calculus theoretical system, in the history of more than 2000 years, after time and again to prove, overthrow, through the selfless dedication and hard research of mathematicians to gradually establish the calculus theoretical system. Dig cultural elements from the history of mathematical development to find rich mathematical culture, the origin of mathematical knowledge, the theorems named by mathematicians, etc., feel the rational brilliance of mathematics, understand the development of truth, and learn a rigorous attitude of scholarship. The history of mathematics silently provides infection and enlightenment for the later generations, and enlightens the later researchers to grow up in a silent way.

In the history of mathematical development, theorems and definitions were constantly overthrown and updated. Hybersos overthrew the theory of "everything is number" and composed a great song of dedication to the truth; The emergence and development of L'Hospital's law warned future generations to adhere to integrity in scientific research. An in-depth study of the history of mathematics development can enable researchers to have a deeper understanding of mathematics knowledge, enable researchers to use the philosophical thoughts reflected in the development of mathematics to guide life, explore problems, and help researchers to develop good moral character and behavior habits.

Epilogue

Mathematical culture is an important part of culture and contains the essential elements of culture. Under the background of China's education reform, exploring the development of mathematics culture, integrating mathematics culture with mathematics knowledge, highlighting the interest, narrative and rational spirit of mathematics will promote the development of mathematics education and mathematics research towards a more harmonious state, and can provide an important boost for the development of mathematics in China.

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