The exploration of calculus in the outlook on life and world outlook--Quantitative change and qualitative change

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Keywords: Course Ideological, Mathematics, Limit.

Abstract: Lide Shuren is the main body of education. “Course Ideological and Political Education” is a specific educational process that allows students to acquire the concept of life and values from the study of professional courses. This article discusses the unity of quantitative change and qualitative change from the limit concept of “Calculus”, thus gaining the cultivation of outlook on life and values. It is also the tip of the iceberg of “course politics.”

1. Introduction

Today, in the national education, “courses are ideological and political”, in order to give play to classroom teaching is the main battlefield of Lide Shuren education, “course politics” runs through every course. Mathematics is the best sample of “Course Ideological Management”. He has the most elements in the “Course Ideological Management”, the most reasonable, and the most techniques and methods. Recently, I saw in the People's Daily Online that the four national departments jointly issued the “Work Plan on Strengthening Mathematical Research”, which is described as follows: “The universe is big, the particles are small, the speed of the rocket, the skill of the chemical, the change of the earth, the biological Mystery, daily use, no mathematics everywhere” (1). Mathematics is the starting point of philosophy, the foundation of disciplines, and the root of education.

The mathematics curriculum itself is a dialectical unity of quantitative change and qualitative change, and the mathematical learning result itself is a dialectical unity of quantitative change and qualitative change. A certain amount of accumulation is the premise and necessary preparation for qualitative change; our ability to learn mathematics and the height change are The inevitable result of quantitative change; the students' hard work and the excellent academic performance are mutually infiltrated; the excellent learning results are the result of hard work and open the way for higher level exploration; every point in education and even every enterprise The change and development of each achievement is the unity of quantitative change and qualitative change. In the study of calculus, we talk about the unity of quantitative change and qualitative change according to the idea of limit theory.

2. The series of limits talk about quantitative change and qualitative change

In the ancient “Zhuangzi. The World” is recorded as such (2): “One foot, one day, half the world, inexhaustible”

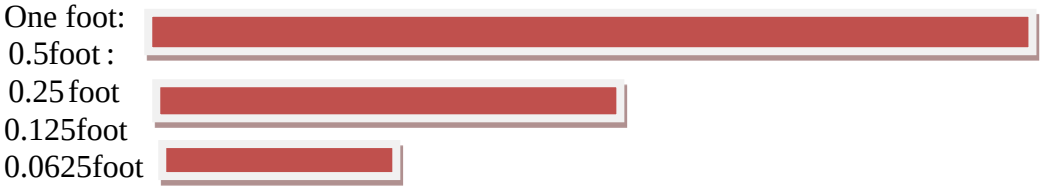

Figure.1 One foot, one day, half the world, inexhaustible”

  DOI: 10.25236/apssh.2019.014

This uses mathematical series to represent the set of wooden stick lengths per day: $\{(\frac{1}{2})^n\}$, that is, the length of the wooden sticks per day is: 1 foot, 0.5foot, 0.25 foot,0.125foot,0.0625foot (Figure 1 above). The following variability descriptions are made by observing the length of the wooden stick each day:

1). When the variable n becomes larger, the length of the wooden stick becomes smaller than 0, that $(\frac{1}{2})^n$, the ruler becomes smaller.

2). When the variable n becomes large, the length of the stick becomes very small and is close to 0, that $(\frac{1}{2})^n$, the ruler becomes small.

3). When the variable n becomes infinite, the length of the stick becomes infinitely close to 0, that $(\frac{1}{2})^n$, the ruler becomes infinitely small.

The above is a description of quantitative change and qualitative change. The order of quantitative change here is: large, large, infinite, and the level of qualitative change is: small, small, infinitesimal. Although these descriptions deal well with the relationship between quantitative change and qualitative change, the processing of mathematics has a higher or highest level, which is unmatched by other disciplines. The limit is the unity of quantitative change and qualitative change.

3. Definition of the series limit

There is an infinite number of columns $\{x_n\}$, if there is a positive ε for any given point (no matter how small he is). There is always a positive integer N such that when n>N, $|x_n - a| < \varepsilon$ holds,

Then the constant a is the limit of the sequence $\{x_n\}$. Remember $\lim_{n\to\infty} x_n = a$, at this time, also known as

The infinite sequence $\{x_n\}$ converges on a, and if the limit of the infinite column $\{x_n\}$ does not exist, the infinite sequence $\{x_n\}$is said to diverge.

The above definition describes the unity conclusions of quantitative change and qualitative change, and describes such changes regularly and accurately. This definition is also called ε, N definition of the series limit. Both are different quantitative side descriptions of ε, N and a uniformity. The unified and mutual penetration, promotion, improvement and positive effects of quantitative change and qualitative change play an active role.

In fact, the understanding of the limit of the infinite number of columns $\{x_n\}$from the quantitative and qualitative changes also includes (3):

(1) The principle of uniqueness: the limit of the infinite sequence $\{x_n\}$ exists, then $\lim_{n\to\infty} x_n = a$, a is unique.

(2) The principle of boundedness: the limit of the infinite sequence $\{x_n\}$ exists, then the infinite sequence $\{x_n\}$ must have bounds.

(3) Principle of the number-keeping principle: the limit of the infinite number column $\{x_n\}$ exists, and $\lim_{n\to\infty} x_n = a$, a>0 (or a<0), there is a positive integer N, so that when n>N, >0 (or <0)

(4) Principle of clamping: Infinite series $\{x_n\}$,$\{y_n\}$,$\{z_n\}$ have:

$$x_n \le y_n \le z_n$$

And $\lim_{n\to\infty} x_n = \lim_{n\to\infty} z_n = A$, then $\lim_{n\to\infty} y_n = a$

The above principles not only let students know the laws of quantitative change and qualitative change, but also tell students to understand the principles and principles of nature, the basis and conditions for exploring natural laws, and tell us the process of understanding nature. It will also change students' value judgments and values, and improve the depth and intensity of students' judgment value.

The unity of quantitative change and qualitative change is also reflected in the consistency of conditions and conclusions. There is a difference between the quantitative change of the over-range and the qualitative change. The famous ancient Greek philosopher Zhifu raised such problems and proved that “Achilles could not catch the turtle.” His proof is this: the tortoise races with the rabbit, stipulates that the tortoise will run first, let the rabbit chase the tortoise, and when the rabbit chases the tortoise, the tortoise is in front of the rabbit. As shown in Figure 2: When the rabbit (point A) catches the turtle's location (point B), the turtle is in front of the rabbit (point C),,,,,, and so on, the tortoise will always be in front of the rabbit, so the turtle won In the competition, this is the famous ancient Greek philosopher Zhifu raised such a problem and proved that “Achilles can't catch up with the turtle”.

We know that the story of “Tortoise and the Hare” is not the same as the condition that “Achilles can't catch the turtle”, but the turtles won the game. The story of “Tortoise and Rabbit Race” in China has influenced the Chinese people for thousands of years and formed the traditional philosophical thinking of Chinese culture. Every Chinese uses it to educate the next generation. Here, the rabbit sleeps, and he has no process of quantitative change. So there is no qualitative change, the turtle's contribution, won the game. And “Achilles can't catch up with the turtle” is a mathematical paradox. When the quantity changes to a certain degree, it will change qualitatively, and here the famous ancient Greek philosopher Zhifu is infinitely subdivided into a small section, where it is infinitely looped. In real life, the rabbit only needs to run to the front of the turtle in one step (as shown in Figure 2 (between point C and D), it does not need to continue indefinitely.

There is a kind of thinking that always thinks that logic and reasoning are correct, and we must get correct conclusions. “Achilles can't catch up with the tortoise” is the product of this kind of thinking, because they violate the unity of quantitative change and qualitative change, and the accumulation of true quantitative change. Must be able to produce qualitative changes.

In the description of quantitative change and qualitative change, infinity and infinity are the two extreme representations of all things. In the cultural representations of human beings for thousands of years, the expressions of such quantitative changes are expressed in infinity and infinity in recent hundreds. This is also the tool that calculus provides a tool for the improvement and sublimation of philosophical thoughts, and creates seeds of countless sciences. Infinity and infinity bring infinite imagination to human thought. Extreme expression in quantitative and qualitative changes is inseparable from calculus.

The following is the infinitesimal definition of calculus: if $\lim\limits_{x\to x_0} f(x)=0$,it is called $f(x)$the infinitesimal of x, it is recorded as 0 or, infinitesimal is just the beginning of the change of things. For any quantitative change results can be written as $\lim\limits_{x\to x_0} f(x)=A$:, (A is a constant)

Then f(x)=A+(0) α (0) is the $\to x_0$ infinitesimal of x, that is, any result A is related to infinity (China has an idiom called dripping water). The following is the finite integral of the calculus: $\lim\limits_{x\to x_0(\text{或}\infty)} \frac{1}{f(x)}=0$,if it is called the infinity of x, $\lim\limits_{x\to x_0(\text{或}\infty)} f(x)=\infty$ it is recorded that infinity is the infinite trend of material changes.

Infinity and infinity are the two extremes of quantitative change and qualitative change, which are obviously dialectical unity.

The relationship between them $\frac{1}{\text{gigantic}}=\text{Infinitesimal}$: $\frac{1}{\text{Infinitesimal}}=\text{gigantic}$.

It can also be represented by two mathematical formula expressions: $\frac{1}{0}=\infty$; $\frac{1}{\infty}=0$ (where 0 means infinity is small)

In the above results of extreme quantitative and qualitative changes, we have the following conclusions:

A represents a finite function, K represents a bounded function, C represents an arbitrary constant, 0 represents infinity, and (*) represents a multiplication symbol, then:

0+0=0; 0*0=0; K*0=0; C*0=0

$A+\infty=\infty$; $A*\infty=\infty$; $K+\infty=\infty$; $\infty*\infty=\infty$

$(+\infty)+(+\infty)=+\infty$; $(-\infty)+(-\infty)=-\infty$.

$\frac{0}{0}, \frac{\infty}{\infty}, \infty\pm\infty$ The result is undecided.

The above ten formulas are determined, and the three are undefined, indicating the relationship between the calculation and derivation of the important results of extreme quantitative change and qualitative change.

In the unity of quantitative change and qualitative change, the expression of mathematics is very specific, accurate, and diverse. It can be used in each formula, theorem, definition, lemma, axiom, regulation, graphics... A unity of quantitative change and qualitative change can also be used to express the unity of quantitative change and qualitative change by using multiple formulas, theorems, definitions, lemmas, axioms, regulations, figures, etc. Many aspects show the unity of quantitative change and qualitative change, so that its value can be seen at a glance. In the education of life and values, mathematics education plays a key role.

Acknowledgements

Project Name: Course Ideological and Political-----Exploration of Cultivating World View, Outlook on Life and Values in Calculus Teaching(No.2019Yj14)

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