RESEARCH ON DERIVATIVES AND APPLIED TEACHING STRATEGIES IN HIGH SCHOOL

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ABSTRACT

Whether it is junior high school or high school, derivatives are an important part of all students' learning in the curriculum. Derivatives and their applications play an important role in the study of function monotonicity, extrema and maximum, and the use of derivatives to prove inequalities, which is not only the core of problem solving, but also the perfect combination of number and shape, and also the concentrated embodiment of calculus ideas. Especially in recent years, high school derivatives and applications have accounted for an increasing proportion of the test papers of the high school entrance examination and the college entrance examination, and it is also the key for students to reflect the core literacy of mathematics of students. If students want to get a high score in the college entrance examination, they must not only understand the concept of derivatives and the application of theorems, but also master the basic knowledge of derivatives and the application of derivatives in life. Because "Derivatives and Applications" is a very important chapter in high school mathematics, students are required to master it to the best of their ability, and students need to invest a lot of energy and time in this area. It also needs the active guidance and help of teachers. Through the research background and theoretical basis of "Derivatives and Applications", this paper analyzes the current situation of "Derivatives and Applications" in modern high schools, and proposes effective teaching strategies that can effectively improve teaching efficiency and formulate effective teaching strategies suitable for all students.

Keywords: Derivatives and applications; analysis of the current situation; Teaching Strategies.

Chapter I prolegomenon

1.1 Background

As early as the middle of the seventeenth century, in the early stage of the development of capitalism in Europe, due to the gradual transition of the production mode of the factory from manual to machine, the productivity also increased rapidly, thus promoting the development of science and technology, and a major achievement in the development of science and technology was the birth of ——calculus.

The founders of calculus were Newton and Leibniz, respectively, who originally established calculus on the basis of intuitive infinitesimal quantities, so this discipline was also called infinitesimal analysis in the early days, which is also the origin of the name of the course mathematical analysis in the university curriculum. However, Newton and Leibniz studied calculus from the point of view of kinematics and geometry, respectively. Since its creation, calculus has become the greatest mathematical tool discovered in the seventeenth century. Calculus has also been one of the great mathematical tools until the twenty-first century.

1.2 Research implications

The discovery of derivatives has helped us solve many problems, such as: militarily, the problem of the longest range of artillery shells can be solved; In astronomy, it is possible to

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calculate the farthest and closest distance between the planet and the sun, and in real life, it can also solve the problems of making tools under what conditions make the materials the most economical, the shortest and the most efficient. Derivative, also known as derivative value. Also known as micro-quotient, it is an important conceptual basis in calculus. It is also an important part of high school mathematics teaching, if students want to get a high score in the college entrance examination, they must not only understand the concept of derivatives and theorem applications, but also master the basic knowledge of derivatives and the application of derivatives in life. In the teaching of derivatives and applications, the teacher is the guide who leads the students' learning, and the students are the main body of learning. Therefore, the teaching of high school derivatives requires the joint efforts of teachers and students, and school leaders should strengthen the research on high school derivatives and applied teaching strategies. Based on the teaching status of "derivatives and their applications" in high school mathematics, this paper discusses the relevant teaching strategies.

Especially in recent years, high school derivatives and applications have accounted for an increasing proportion of the test papers of the high school entrance examination and the college entrance examination, which is also the key to whether students can achieve good results. If students want to get a high score in the college entrance examination, they must not only understand the concept of derivatives and the application of theorems, but also master the basic knowledge of derivatives and the application of derivatives in life. In the teaching of derivatives and applications, the teacher is the guide who leads the students' learning, and the students are the main body of learning. Therefore, the teaching of high school derivatives requires the joint efforts of teachers and students, and school leaders should strengthen the research on high school derivatives and applied teaching strategies. Therefore, this paper proposes corresponding teaching strategies on the theoretical basis and current situation analysis of derivatives and applications, so as to better improve the teaching efficiency of "high school derivatives and applications" in the future, and help students to quickly and comprehensively grasp the knowledge of derivatives.

1.3 Research content

The main research content of this paper is the research on high school derivatives and applied teaching strategies. The research in this paper is mainly to clarify the research background of high school derivatives and applications and the significance of this project by consulting relevant materials on the Internet and relevant books in libraries. Then, through the analysis of the current teaching situation of derivatives and their application in actual high school classrooms, effective teaching strategies suitable for all students are formulated.

1.4 Research Methodology

Literature Research Method: According to the research purpose of studying high school derivatives and applied teaching strategies, the literature in the network is investigated to obtain information, so as to comprehensively and correctly understand and master the high school derivatives and applied teaching strategies to be studied.

Survey Method: Purposeful, planned and organized collection of the current situation of high school derivatives and applied teaching strategies in various colleges and universities, and the analysis of the current situation of high school derivatives and applied teaching strategies mentioned in various news and online reports, so as to better carry out the research of this paper.

Interview Method: Focusing on high school derivatives and applied teaching strategies, a series of relevant questions are raised, and through in-depth and detailed communication with students and teachers on these questions, we can understand what difficulties exist in carrying out relevant teaching and draw conclusions that are beneficial to this paper through communication.

Chapter II Theoretical basis

The theoretical basis of calculus can be roughly divided into two parts. One is the theory of real infinity, that is, wireless is a concrete thing, a real existence; The other is the latent infinity theory, which refers to an ideological process, such as infinite proximity.

2.1 Definition and geometric meaning of derivative

Definition: Let the function y=f(x) be defined in a certain neighborhood of the point, and when the independent variable x has an increment at the place and （$x_0+\Delta x$） is also in the neighborhood, the function will obtain the increment Δy=f（$x_0+\Delta x$）-f(x_0); If the limit exists when Δy 与 Δx → 0, then the function y=f(x) is said to be derivative at the point, and this limit is called the derivative of the function y=f(x) at the point, denoted as① $f'(x_0)$；

② $y'|_x = x_0$;③ $\frac{dy}{dx}|_{x=x_0}$; $f'(x_0)=\lim_{\Delta x\to o}\frac{\Delta y}{\Delta x}=\lim_{\Delta x\to o}\frac{f(x_0+\Delta x)-f(x_0)}{\Delta x}$

It should be pointed out： $f'(x_0)=\frac{lim}{\Delta x\to 0\frac{f(x_0+\Delta x)-f(x_0)}{\Delta x}\frac{f(x)-f(x_0)}{x-x_0}}$

2.2 Several derivatives of functions

Four operations on derivatives:

- $\frac{d^n}{dx^n}(u\pm v)=\frac{d^n}{dx^n}u\pm\frac{d^n}{dx^n}v$
- $\frac{d^n x}{dx^n}(Cu)=C\frac{d^n}{dx^n}u$
- $\frac{d^n}{dx^n}(u\cdot v)=\sum_{k=0}C_n^k\frac{d^{n-k}}{dx^{n-k}}u\frac{d^k}{dx^k}v$ （莱布尼兹公式）

Higher-order derivative arithmetic

①（$u\pm v$）$'=u'+v'$

②（$uv)'=u'v+v'u$

③（$\frac{u}{v})'=\frac{u'v-v'u}{v^2}$

2.2.3: Derivative of Variable Limit Integrals:

$\frac{d[\int_{a(x)}^{b(x)}f(x,t)dt}{dx}=f(x,b(x))b'(x)-f(x,a(x))a'(x)$ (a(x) b(x) is a subfunction)）

Finding the higher derivative

① Direct method: Gradually find the higher-order derivative from the definition of higher-order derivatives

② Algorithm: • $\frac{d^n}{dx^n}(u\cdot v)=\sum_{k=0}C_n^k\frac{d^{n-k}}{dx^{n-k}}u\frac{d^k}{dx^k}v$ (Newton-Leibniz formula)

③ Indirect method: using the known higher-order derivative formula, through the four rules of operation, variable substitution and other methods. Some special methods of derivation

Chapter III Current Situation and Analysis of High School Derivatives and Applied Teaching

3.1 Poor understanding of the concept of derivatives

As teenagers grow older, their logical thinking ability is gradually improving, but they still lack some "heat" in the formation of mathematical thinking and related mathematical concepts, as well as the ability to understand and master concepts. Some conclusions can be drawn through the analysis of big data, in the teaching of the concept of derivative, in order to pursue the progress of the class and the efficiency of the lecture, many teachers do not draw conclusions about the concept of derivative through the specific and detailed derivation process, but directly tell students what the definition of derivative is. As a result, students only memorize the general concept of derivatives, but they do not actually understand what is a derivative, nor do they understand how the concept of derivatives is derived. As a result, students are vague and unaware of the concept of derivatives and their formation. I think that as long as you can calculate the derivative, you can do it. Because the concept of derivative is too abstract, and students have no intention of understanding and studying the concept of derivative and the teacher has no intention of focusing on the concept of derivative at the beginning, it will lead to some students losing interest in derivative, which will lead to more difficult learning of derivatives in the future, and the learning efficiency will become lower and lower.

Examples: ①若 $\lim\limits_{\Delta\to 0}\dfrac{f(x_0+\Delta x)-f(x_0)}{\Delta x}=k$，则 $\lim\limits_{\Delta x\to 0}\dfrac{f(x_0+2\cdot\Delta x)-f(x_0)}{\Delta x_0}$ 等于（A）解：

由于 $\lim\limits_{\Delta x\to 0}\dfrac{f(x_0+2\cdot\Delta x)-f(x_0)}{\Delta x_0}=\lim\limits_{\Delta x\to 0}\dfrac{f(x_0+2\cdot\Delta x)-f(x_0)}{2\cdot\Delta x}\cdot 2$

$=2\cdot\lim\limits_{\Delta x\to 0}\dfrac{f(x_0+2\cdot\Delta x)-f(x_0)}{2\cdot\Delta x}$ =2k

② Knowing the curve y=x+$\dfrac{1}{x}$ the previous point A(2,$\dfrac{5}{2}$), use the slope definition to find that:

The slope of the tangent of point A

Tangent equation at point A

Untie: $\bullet\,\Delta y=f(2+\Delta x)-f(2)=2+\Delta x+\dfrac{1}{2+\Delta x}-(2+\dfrac{1}{2})=\dfrac{-\Delta x}{2(2+\Delta x)}$

$\lim\limits_{\Delta x\to 0}\dfrac{\Delta y}{\Delta x}=\lim\limits_{\Delta x\to 0}[\dfrac{-\Delta x}{2\Delta x(2+\Delta x)}+\dfrac{\Delta x}{\Delta x}]=\lim\limits_{\Delta x\to 0}[\dfrac{1}{2(2+\Delta x)}+1]=\dfrac{3}{4}$

The tangent equation is y-$\dfrac{5}{2}=\dfrac{3}{4}(x-2)$., 3x-4y+4=0

The derivative method used in this problem is to find the instantaneous velocity of a moving object S=S(t) at time by definition.

3.2 The application of derivatives is not flexible

There are several main applications of high and high derivatives: monotonicity, extrema and maximum, proof of inequalities, etc.

3.2.1 Monotonicity

The derivative is an important tool for studying functions, and the use of derivatives can quickly find the monotonicity of a function, and there is no need to use the definition of the function to solve the monotonicity of the function as before. The monotonicity of a function can be obtained by finding the derivative of a function in a certain interval, so it is one of the most important applications of derivatives to discuss the monotonicity of a function or to find the monotonic interval of a function using derivatives. However, there are some problems in

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the process of using derivatives to find the monotonicity of functions.
It is not clear how the monotonicity of a function relates to the derivative

In a definite interval, the derivative of the function is obtained, and if the derivative is greater than 0, the function increases monotonically in this interval. If the derivative is less than 0, the function is monotonically decreasing in this interval. If the derived derivative is equal to 0, then the original function is constant.

Note: When judging the function image by using the connection between the derivative and the monotonicity, it is necessary to pay attention to the range of the derivative greater than 0 and the derivative less than 0 to judge the monotonicity of the function in the corresponding range.

3.2.2 Extrema and maximum

①Definition of extreme value: If a function has a definite value everywhere in the neighborhood of a certain point, and the value at that point is the maximum (small), then the value of the function at this point is a maximum (small) value. If it is larger (smaller) than the value of the function at all other points in the neighborhood, it is a strictly maximum (small).
Finding extrema using derivatives:
Find the derivative of the function as $f'(x)$, if $f'(x)=0$
If we get $f'(x)>0$ in the left area of the point and $f'(x)<0$ in the right area of the point, then f is the maximum.
If you get $f'(x)<0$ in the left area of the point and $f'(x)>0$ in the right area, then it is a minimum.

The necessary condition for the extreme value of the function is: let the function f(x) be derivable at the point and obtain the extreme value at the point, then $f'(x_0)=0$. It is a mistake to mistake a necessary condition for a sufficient condition.

②Maximum: If a point in an interval function is the maximum value of the interval at a certain point in the interval, then the value corresponding to this point is the maximum value of the interval, and conversely, if a certain point in the interval function in a certain interval is the minimum value of the interval, then the value corresponding to this point is the minimum value of the interval.

Students tend to confuse the extreme value and the maximum value of a function, thinking that the maximum value obtained at a certain point is the maximum value of the function, which leads to such a wrong belief that in the final analysis, it is the students' ignorance and lack of grasp of the concept of the extreme value and the maximum value of the function. An extreme value is the maximum value of a function near a certain point, but it is not necessarily the maximum value over the entire interval. The maximum value is the maximum value of a certain range, and the extreme value is not necessarily the maximum value. And the extrema only reflects the local properties of the function.

3.2.3 Derivatives and Inequalities

The use of derivatives to prove inequalities is also the focus of high school exams, and the use of derivatives to prove inequalities requires the construction of new functions, and the full use of the extreme and maximum values of derivatives to solve the proof of inequality.
For example, if it is proved that for any x[a,b] there is f(x)<=g(x), then let h(x)=f(x)-g(x), then

only need to prove that h(x)<=0, as long as the derivative is used to prove that h(x) has a minimum value on [a,b], and the minimum value is 0.

The use of derivatives to prove inequalities is often a direct proof of the inequality given by the problem, and it is necessary to construct a new inequality by shifting the direction, and then prove it after finding the derivative. This requires students to have flexible thinking and be able to think analytically in a variety of ways. In the teaching of mathematics in high school, students are required to be able to apply what they have learned and be able to draw inferences. Using derivatives to prove inequalities requires students to think outside the box and have the courage to try new ideas for solving problems. Because using derivatives to prove inequalities requires a combination of derivatives, extremums, and monotonicity of functions, this means that many problems arise in the process of proving inequalities.

Note: In this problem, we need to pay attention to the definition domain of the new function, and when judging the monotonicity of the function according to the derivative of the function, the derivative is greater than zero and the original function is monotonically increasing, and pay attention to the change of the sign when shifting. Students don't always have a good grasp of the derivative, extrema, maximum, and monotonicity of functions. Students tend to confuse concepts, lack the coherence of knowledge, and are unable to apply what they have learned. When they encounter difficult problems, they are easily stumped, unable to see the essence of the problem, and unable to solve the problem independently.

In general, the reason for these problems is that the students' logical thinking ability is not mature enough, and they are still slightly lacking in knowledge understanding and application. Students cannot be the masters of their own learning, cannot think independently and solve problems, and students often memorize knowledge to help themselves memorize by brushing a large number of questions. This also leads to mechanical learning, which lacks the flexibility of learning and loses the ability to actively explore new knowledge. The role of teachers as "guides" is also unsuccessful, unable to correctly guide students in the learning of new knowledge, resulting in students often confusing concepts and using formulas and theorems to solve problems.

Chapter IV High School Derivatives and Applied Teaching Strategies

4.1 Student-oriented, students are the main body of learning

In order to thoroughly grasp the chapter "Derivatives and Applications", it is necessary to understand that in teaching, students are the main body of learning, and teachers are only the guides and organizers of students' learning. Be student-oriented, don't put the cart before the horse. In order for students to be the masters of classroom teaching, teachers should uphold the concept of student-centered teaching. Therefore, teachers should guide students to learn by creating corresponding problem scenarios, and let students learn actively through observation, discovery, and analysis, rather than directly informing theorems and conclusions. Through the continuous creation of variable classroom activities, we can stimulate students' interest in mathematics and mobilize students' subjective awareness and learning needs, so that students can carry out independent learning and become the real masters of the classroom.

First of all, in the teaching of concepts, in order to pursue the progress of class and the efficiency of teaching, many teachers do not teach the concept of derivatives through specific and detailed derivation processes, but directly tell students what the definition of derivatives is. As a result, students only memorize the general concept of derivatives, but they do not actually understand what is a derivative, nor do they understand how the concept of derivatives

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is derived. As a result, students are vague and unaware of the concept of derivatives and their formation. I think that as long as you can calculate the derivative, you can do it. Because the concept of derivative itself is very abstract, it is often difficult for students to understand, in order to give students a deeper understanding of the concept of derivative. In addition to the conventional use of mathematical language to explain the concept of derivatives, teachers can also use multimedia presentations and analysis of practical problems. For example, the method of measuring instantaneous speed in real speed measurement, combined with multimedia demonstrations, for example, by allowing students to experiment with the average speed calculated when the car is driving, a new concept of instantaneous speed is gradually introduced, and then the concept of derivative is learned.

Secondly, on the basis of students' understanding of the concept, they can be consolidated through practice exercises, and students will be exposed to a lot of problems in the process of solving problems, which requires teachers not to directly inform students of the answers, but to guide students, you can give students a little hint, and then let students think independently, and guide students step by step. Finally, the exercises are explained. In this process, students can not only think independently, but also exercise their patience and independent inquiry ability.

Finally, the problem situation is created, and the reason why students think that mathematics is boring is that mathematics is logical and rigorous, which is different from the colorful and colorful real life, and lacks color. In the teaching of derivatives, teachers can introduce students to the history of mathematics about calculus, and on the one hand, this change in teaching methods will make students feel new and improve the enjoyment of learning derivatives. On the other hand, calculus has a history of development over the past 100 years, and there are many short stories worth exploring, and introducing students to the calculus courses of Newton and others can not only improve students' mathematical literacy, but also stimulate students' interest in learning and encourage them to learn derivatives.

4.2 Clarify individual differences and teach students according to their aptitude

As an individual, each student naturally has individual differences, and students have their own unique personality traits; the way of learning and thinking about problems; The degree of intellectual development is different. For students with different intellectual abilities and students with high intelligence, teachers need to be patient and careful to help and guide students. Students should not be coldly violent just because they have low IQs. Teachers can learn the concept of derivatives by using real-life examples, such as allowing students to experiment with the average speed calculated when a car is moving, and then gradually introduce the concept of instantaneous velocity. When learning "Derivatives and Applications", teachers can help students better understand the problem of using derivatives to find extreme values and monotonicity of functions by asking students to calculate the conditions under which materials to use are most economical. For students with high intelligence, teachers should actively encourage all students, but do not let students be overly proud and arrogant. When appropriate, such students can adopt the method of self-study, which can give full play to students' subjective initiative and active exploration ability. For introverted students, teachers can actively guide students to answer questions in class and give students timely encouragement, so that introverted students can have more confidence in learning and have the courage to express their ideas. For students with a single way of thinking about problems, students can be exposed to more question types such as using derivatives to prove inequalities and function monotonicity, so that students can learn to think and solve problems from multiple perspectives, and train students' logical thinking ability to achieve diversified thinking problems. Teachers can also do as much as possible to solve a problem as many as possible when solving the exercises about derivatives, and through the teacher's words and deeds, students will gradually find another way to solve the problem when they are doing it. In this way, students' creative thinking can be developed, so in the teaching of "derivatives and applications", teachers should be clear about the individual differences of students, and should not adopt only one teaching method for all students, but should teach students according to their aptitude.

4.3 Give full play to the role of teachers as guides of students' learning

Although the bachelor's degree is the main body in the classroom, the teacher is also an indispensable part, and the role of the teacher as the guide of students' learning is also very important. Therefore, teachers must have a good grasp of professional knowledge. Before the teaching of "derivatives and applications", the content to be taught should be systematically planned, the teaching design should be done, and the teaching objectives and the major difficulties of the lesson should be clarified, so as to facilitate the gradual hierarchical teaching of the content of the lesson, and it is easier to grasp the rhythm of the class.

Because the concept of derivatives is relatively abstract, teachers can choose more vivid and humorous teaching methods when teaching, so as to stimulate students' interest in learning. Because the content of "Derivatives and Applications" is not easy to understand and the content involved is very complicated, teachers can help students reduce stress by creating a good learning environment before classroom teaching, devote themselves to classroom teaching, and give full play to the teacher's guiding role.

4.4 Teachers should be strict with themselves and lead by example

When completing the classroom teaching of high school derivatives, it requires the joint efforts of teachers and students, and a complete classroom needs to be taught by students and taught by both teachers. If you want students to have good grades, you also need the unremitting efforts and patience of teachers. Therefore, if you want to improve teaching efficiency, teachers also need some basic professional qualities.

First of all, as a teacher, you should love your job, maintain passion and love for the subject you teach, get along with students like friends, and don't let students feel that teachers are superior. In classroom teaching, it is necessary to calm down and communicate with classmates, understand students' confusion, understand students' troubles, and help them solve problems in life and study. The mode of getting along with teachers and students should not only be simple teachers and students, but also get along like friends, so that students can truly experience love and sincerity, and perhaps a little care from teachers will win students' gratitude for a lifetime. Students will "love the house and the black" because they like the teacher, and then like the subject that the teacher teaches.

Secondly, teachers should study the business seriously and continue to learn and innovate. As a teacher, whether in the teaching process or in the improvement of teaching methods, you need to constantly innovate and learn like your colleagues. Constantly explore the education and teaching methods that are suitable for themselves and their students, maybe this method is suitable for individual students, maybe this method is suitable for students with good learning level, in short, teachers need to constantly enrich themselves on the "road" of teaching.

Thirdly, we must lead by example, be disciplined, and have a sense of responsibility. What students are asked to do, teachers themselves must do first. It's easy to say, but it takes a lot of faith to do it. It is a violation of discipline for students to be occasionally late, especially for teachers. Teachers themselves are required to abide by the rules and regulations of the school, infect students with a high sense of responsibility, encourage students, and make them imperceptibly influenced. All in all, the one who always works hard, always perseveres, and always learns is a conscientious teacher. Teachers should insist on learning while teaching students, after all, learning is endless, and now students' intelligence is very high, and the questions have become more and more difficult in recent years. Therefore, teachers need to constantly improve themselves and accumulate knowledge in order to better help and teach students.

CONCLUSION

Because "Derivatives and Applications" is a very important chapter in high school mathematics, students are required to master it to the best of their ability, and students need to invest a lot of energy and time in this area. It also needs the active guidance and help of teachers. Through the research background and theoretical basis of "Derivatives and Applications", this paper analyzes the current situation of "Derivatives and Applications" in modern high schools, and proposes effective teaching strategies that can effectively improve teaching efficiency and formulate effective teaching strategies suitable for all students.

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