Exploration and Reflection on Integrating Ideological and Political Education Theory into the Teaching of Higher Mathematics

Xin Xue, Jing Kong, Rui Chen, Liang Fang*

College of Mathematics and Statistics, Taishan University, Tai'an, China

*Email:fangliang3@163.com

Abstract—**Ideological and political education is a new educational concept that takes "cultivating morality and nurturing people" as the fundamental task of education. We have selected the teaching modules such as minimal quantities, Lagrange's median theorem, derivatives and their calculations in the higher mathematics course, and explored the organic integration of the higher mathematics with the Ideology-Politics teaching. Compared with the traditional teaching mode, the integration of ideology and politics into the teaching is beneficial to focus students' attention, enhance students' national pride, help students set up a correct outlook on life and values, and better carry out the teaching philosophy of educating the students and cultivating morality in them.**

Index Terms—**Ideological and political education, the higher mathematics, Course design**

I. INTRODUCTION

In May 2020, the Ministry of Education issued the Guidelines for the Construction of Ideological and Political Education in Higher Education Courses, which deployed and guided the work of the construction of ideology and politics in colleges and universities in nine aspects, making it clear that ideological and political education should be carried out throughout the system of talent cultivation, comprehensively advancing the construction of ideology and politics in colleges and universities, giving full play to the nurturing role of each course, and improving the quality of talent cultivation in colleges and universities.As one of the core public courses for science and engineering majors in institutions of higher education, higher mathematics has an irreplaceable role in cultivating students' logical reasoning and abstract thinking ability, enhancing their spatial imagination and innovative thinking ability, and is crucial to the formation of students' mathematical literacy and the subsequent learning of professional knowledge.Integrating the elements of ideology and politics into the higher mathematics classroom can guide students to establish a scientific worldview, outlook on life and values while imparting knowledge. In this process, teachers can also improve themselves in the teaching process, communicate with students more deeply, find students' flash-points, explore outstanding talents, and cultivate talents for the country, as well as cultivate a deeper teacher-student relationship, and help students grow faster and better [1-4].

In the teaching practice of ideological and political education in higher mathematics courses, there are still some problems that need to be solved. Higher mathematics courses are highly logical, abstract and applied, which seem to be "irrelevant" to the ideological and political education. These characteristics make the natural and silent integration of ideological and political education elements more challenging than humanities and social sciences courses. In this paper, we will take the limits of functions, infinitesimal quantities and indefinite integrals as examples to explore how the elements of ideological and political education are embodied in the actual classroom teaching.

II. COURSE ESIGNS OF IDEOLOGICAL AND POLITICAL EDUCATION THEORY ON INFINITELY SMALL AMOUNTS

A. Teaching goal

(1)Correctly understand that infinitesimals are variables and should not be confused with zero. Grasp the mathematical concept of infinitesimals, understand the properties of infinitesimals, and understand the difference between the properties of infinitesimals in the finite and infinite cases.

(2) Cultivate students' scientific spirit of critical thinking and questioning, develop the spirit and practical ability of active exploration and innovation, and carry forward the spirit of the times under the new engineering education; cultivate students' materialistic and historical outlook and dialectical thinking ability, look at problems from the perspective of change, get rid of the limitations of limited thinking, and realize the transformation of the mathematical way of thinking.

B.Methods of integrating ideological and political education theory in the course

(1)Begin by asking students:Does an infinite loop of 0.999 equal 1?

(2)Analyse the answers and give a historical account of the development of infinitesimals. Newton and Leibniz introduced the concept of "infinitesimals" to explain this problem. That is, the difference between an infinite loop of 0.999 and 1 is an "infinitesimal". An infinitesimal is infinitely close to 0, but no constant other than 0, no matter how small, is an infinitesimal. Although both Newton and Leibniz based their theories of calculus on the concept of infinitesimals, their understanding of this concept was confused. The tool of calculus was attacked from its inception, most violently by the

English Bishop Berkeley. Beckley's problem is called "Beckley's paradox" [2]. Generally speaking, "Beckley's paradox" can be expressed as the problem of "whether the infinitesimal quantity is 0 or not": in terms of practical application of the infinitesimal quantity at that time, it must be 0 and not 0 at the same time, but from the point of view of formal logic, this is undoubtedly a contradiction. The second mathematical crisis arose from this [3]. In response to Berkeley's attack, both Newton and Leibniz tried to solve the second mathematical crisis by refining their calculus theories, but without complete success. The reason for this was that no one could say what infinitesimals were. It was not until the great mathematicians Cauchy and Weierstrass clarified this problem. Because they knew that although infinitesimals were not clear, the calculus was clearly correct, and this was the ε-N language. Cauchy used the ε- N language to define the limit, thus skipping the concept of "infinitesimals", and using the limit point of view to illustrate the correctness of the calculus.

C.Course summary

Looking back at history, any science is in the criticism, questioning and denial of continuous progress! The discovery of the truth is inseparable from the hard work of scientists, it is with the scientists serious research, perseverance, so that science and technology continue to develop and progress. This inspires the students in their studies in general to hold the spirit of questioning and criticism, more thinking in order to continue to progress.

III. COURSE ESIGNS OF IDEOLOGICAL AND POLITICAL EDUCATION THEORY ON THE LAGRANGE MEDIAN THEOREM

A. Teaching goal

(1)Understand the conditions, conclusions and corollaries of Lagrange's Median Theorem, and clarify its geometric significance; be able to use Lagrange's Median Theorem and construct auxiliary functions to prove the relevant inequalities.

(2)By continuously relaxing the conditions of the median theorem, a result of universal significance is obtained, which reveals the law of going from the particular to the general and implies the principle of particularity and universality in Marxist philosophy.

B.Methods of integrating ideological and political education theory in the course

(1)Firstly, the role of Lagrange's Median Theorem is clarified, i.e., the link between the basic theory of differentiation and its practical applications, so that students can understand the value of what they are about to learn.

(2)Secondly, through the introduction of Rolle's theorem, students are guided to explore: if the first two conditions of Rolle's theorem, "the function is continuous in $[a,b]$" and "it is derivable in (a,b)", and the third one, "$f(a)=f(b)$", does not hold, what conclusion can be drawn? The third condition "$f(a)=f(b)$" does not hold, what conclusion can be drawn? In this process, the teacher can through the classroom display endpoints take different values of the smooth curve, and then by rotating the curve so that the endpoints take the same value,

the use of Rolle's theorem to get the tangent line and the endpoints parallel to the line, and then rotate the curve back to the original position, so that students can observe the tangent line and the endpoints of the line of the position of the relationship. Guiding students to observe and think, the conclusion that "the tangent line is parallel to the endpoints", so as to get the content of Lagrange's Median Theorem: there is at least one point on the curve that the tangent line of the point is parallel to the entire length of the chord. [5] examined the development and refinement of possible mathematical models for the intellectual system of career guidance. Mathematical modeling of knowledge expression in the career guidance system, Combined method of eliminating uncertainties, Chris-Naylor method in the expert information system of career guidance, Shortliff and Buchanan model in the expert information system of career guidance and DempsterSchafer in the expert information system of career guidance method has been studied. [6] discussed that according to the observations in this paper, an existing mathematical model of banking capital dynamics should be tweaked. First-order ordinary differential equations with a "predator-pray" structure make up the model, and the indicators are competitive. Numerical realisations of the model are required to account for three distinct sets of initial parameter values. It is demonstrated that a wide range of banking capital dynamics can be produced by altering the starting parameters.

C.Course summary

Rolle's theorem focuses on the special, static, absolute and strict conditions, thus the conclusion is more special; Lagrange's median theorem focuses on the movement, relative and relaxed conditions, thus the conclusion is more general. Both contain the principle of Marxist philosophy of particularity and universality. In the relationship between the two theorems, by relaxing the conditions to make the conclusion more and more general, and then constantly expand the scope of application of the theory, leading students to understand that when the authorities are limited to a certain condition to look at the problem, the conclusions often also have limitations; and when the view is opened up to make the conclusion more and more general, the conclusion is often also limited. When the authorities are limited to a certain condition to look at the problem, the conclusion is often limited; and when the perspective is opened and the conditions are relaxed to look at the problem, the conclusion is often more comprehensive and more universal significance.

IV. COURSE ESIGNS OF IDEOLOGICAL AND POLITICAL EDUCATION THEORY ON THE DERIVATIVES AND THEIR CALCULATIONS

A. Teaching goal

(1)To understand the practical background of the concept of derivative and the geometrical significance of the derivative; to master the calculation of the derivative, including the four operations of the derivative, the derivatives

of composite functions, the derivatives of implicit functions, the derivatives of functions determined by parametric equations, and the calculation of higher-order derivatives; and to appreciate the role of the derivative in the solution of practical problems.

(2)Through the examples of the application of derivatives, students will have a deeper understanding of the fact that mathematics does not exist in isolation from life, but is closely related to various problems in daily life, and that only by learning mathematics can we better solve the problems in life.

B.Methods of integrating ideological and political education theory in the course

(1)When introducing the concept of derivative, traditional teaching usually gives two examples: one is the instantaneous speed of variable-speed linear motion, and the other is the slope of the tangent line to a curve at a point, which are physical and geometrical problems respectively. If we directly explain the examples to introduce the concept of derivative, the content is boring, students are not easy to understand, so we can use the case of "China's high-speed rail" to explore. Before the lesson, teachers set up a discussion question on the cloud platform: How to understand the derivative? Students often give similar answers such as "the derivative is the speed" or "the derivative is the acceleration", which shows that students have a general understanding of the derivative, but lack of accurate knowledge.

In order to let students have a deeper understanding of the derivative and better integrate the contents of ideological and political education into what they have learned, the teacher can play the videos of high-speed railway travelling at high speed on the track and high-speed railway making a smooth turn at the curve in the class to introduce to the students that the high-speed railway technology of our country enjoys a high reputation all over the world and it has already become a beautiful business card, and in the process, guide the students to observe and think about how to calculate the speed shown on the display screen of the high-speed railway. How to calculate the travelling speed shown on the display screen of the high-speed railway? How to calculate the travelling speed shown on the display screen of the high-speed railway? In order to ensure the smooth running of the high-speed railway, what is the direction of travelling at the turn of the high-speed railway?

In this way, the case of "China's high-speed railway" represents the two cited examples in the textbook, arouses students' curiosity and desire for knowledge, and makes them participate in the classroom learning and discussion more actively. In addition, through the introduction of the great achievements of China's high-speed railway construction, we can cultivate students' national sentiment and professional mission, and stimulate students' national pride, so as to cultivate students' sense of responsibility and mission to strengthen the country. Through this case, students also have a deeper understanding that mathematics does not exist in isolation from life, but is closely related to various problems

in daily life, and that only by learning mathematics well can we better solve problems in life.

(2) In the section on finding the derivative of an elementary function using the derivative formula, students are guided to be careful in the process of calculation, and to practice and refine the calculation over and over again. The process of finding the derivative is actually similar to the work of a craftsman, thus cultivating the spirit of craftsmanship. In the study of composite function derivatives, in order to facilitate students' understanding and mastery of the calculation, we can use "peeling the onion" analogy: from the outside to the inside, each time only one layer. This leads students to learn whatever, no matter how complicated, can be like "peeling onions" like from the outside to the inside, from the surface to the inside of the decomposition, down-to-earth to the core of the contents of the real understanding of the core, and ultimately to be able to learn by example, integration.

In the future, you can also break down the complexity of the work into several simple parts, not only to improve the accuracy, but also will not affect the enthusiasm of the work. In this way, students are guided to establish a positive outlook on life and face their studies and life positively.In the process of calculation of higher order derivatives, we guide students to calculate the higher order derivatives by first order derivatives, then step by step derivatives, and finally the nth order derivatives, and we should also take a step by step approach in our study and life, and we should not fish for three days and sunbathe for two days in everything, we should be down-to-earth and take one step at a time.

C.Course Summary

"Derivative and its calculation" teaching module in higher mathematics courses have an important role, but also the calculus idea, the combination of number and shape, the full embodiment of the curved instead of straight, which involves the basic knowledge, mathematical ideas and research methods is not only the basis for students to learn the professional courses, but also in the teaching of practical cases can be combined with the cultivation of a sense of responsibility and awareness of responsibility, inspire the students' human ecology, and subconsciously combine the knowledge of the study with the value of the lead, and silently cultivate the students' correct outlook on the world, outlook on life, values, and to achieve the fundamental task of moral education.

V. CONCLUSION

At present, the course team has summarized some cases of ideology and politics, but it is not enough. The construction of Civics and Politics in the curriculum is a systematic project. Teachers should further strengthen the awareness of nurturing people, find the right angle of nurturing people, and make gradual progress to improve the effect of teaching by taking the point as a whole. Teachers should bear in mind the original purpose of ideological education in the courses. Teachers should fully combine the characteristics of the mathematics subject, integrate the mathematics curriculum

with the elements of ideological and political education , and make use of the time for ideological and political education such as early learning before the class, teaching in the classroom, and answering questions in the classroom, so as to make the ideological and political education invisible, but ubiquitous.

REFERENCES

[1] Y.X.Zhang,Exploration and Practice of Embodying Elements of Philoso phical Thought in the Teaching of Higher Mathematics in the Context of Cu rriculum on ideological and political education. Journal of Tonghua Normal College,2021(04):120-125.

[2] X.T.Han,Mathematical paradoxes and three mathematical crises. Hunan Science and Technology Press,2006.

[3] S.Gong, L.J.Lin,A Brief History of the Development of Calculus.Hunan Science and Technology Press,2005.

[4] Z.F.Zuo, Y.M.Huang,J.Wang,A study of the case study teaching design of higher mathematics course ideology and politics taking the concept of der ivatives as an example.Three Gorges Higher Education Study,2022(2):32-3 6.

[5] Christo Ananth, A.R. Akhatov, D.R. Mardonov, F.M. Nazarov, T. AnanthKumar, "Possible Models and Algorithms for the Intellectual System of Professional Direction", International Journal of Early Childhood Special Education, Volume 14, Issue 05, 2022,pp. 4133-4145

[6] Christo Ananth, N. Arabov, D. Nasimov, H. Khuzhayorov, T. AnanthKumar, "Modelling of Commercial Banks Capitals Competition Dynamics", International Journal of Early Childhood Special Education, Volume 14, Issue 05, 2022,pp. 4124-4132.