

Research and Practice of Integrating Ideological and Political Education Into Calculus Teaching

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This paper first analyses the reasons for the low effectiveness of ideological and political education in the current calculus teaching, and then puts forward the contents, methods, and approaches of integrating ideological and political education into calculus teaching on this basis, and finally finds out the points for needing attention in the integrating ideological and political education into calculus teaching.

Keywords: ideological and political education, calculus teaching, contents of ideological and political theories teaching in all courses, methods of ideological and political theories teaching in all courses, approaches of ideological and political theories teaching in all courses

Introduction

Ideological and political theories teaching in all courses is a new idea. It is a comprehensive education idea that constructs the pattern of “San Quan” Education, integrates non-ideological and political theory courses and ideological and political theory courses together to form a synergistic effect, and takes strengthening morality and cultivating young persons as the fundamental task of education. It integrates the elements of ideological and political education (including theoretical knowledge, value idea, spiritual pursuit, and so on of ideological and political education) into the non-ideological and political theory courses, and it has a subtle influence on students’ ideology and behaviour. Ideological and political theories teaching in all courses is a new method. It is a method to reflect Marx’s guiding position and practice the socialist core values in the process of implementing the fundamental task of strengthening morality and cultivating young persons. It is a method to persist in the education of Xi Jinping’s socialist ideology with Chinese characteristics in the new era and to achieve the goal of Xi Jinping’s socialist ideology with Chinese characteristics in the new era entering textbooks, classroom, and the mind (Yang, Wang, & Gao, 2020). Ideological and political theories teaching in all courses is a new mode. It is a comprehensive education mode that integrates ideological concepts, infiltrates political views, and promotes moral education in the teaching of non ideological and political professional courses. With the help of professional ideological and political demonstration education courses, it can realize the overall deepening of all kinds of professional knowledge, further implement the fundamental task of strengthening morality and cultivating young persons, and realize all-round education (Shi, Feng, & Xing,

Acknowledgement: The work has been supported by the general project of “project plan” for research of party construction and ideological and political (moral) education “Research and Practice of Integrating Ideological and Political Education Into Calculus Teaching” of Beijing International Studies University in 2021.

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2020). Ideological and political theories teaching in all courses, which belongs to recessive ideological and political education, is an extension of ideological and political courses. It plays the value function of “turning theory into methods and morality” in the teaching of professional subject courses. It embeds the emotion, attitude, and values of different subjects into the teaching system of theoretical knowledge, guides the growth of students’ values, and enables students to learn for application and establishing morality (Li & Pei, 2020).

In the opinions on deepening the reform of undergraduate education and teaching and comprehensively improving the quality of personnel training issued by Ministry of Education of the People’s Republic of China, it is proposed that “ideological and political theories teaching construction in all courses should be regarded as the key link in the implementation of the fundamental task of strengthening morality and cultivating young persons”. In the opinions on guidelines for ideological and political theories teaching construction in all courses in colleges and universities issued by Ministry of Education of the People’s Republic of China, it is also requires that “colleges and universities fully excavate the ideological and political theories teaching elements in all courses, and give full play to the educational effect of each course”. At present, ideological and political theories teaching in all courses has become the key, hot spot, and focus of close attention and in-depth research in teaching reform of colleges and universities and teachers. However, the research and practice of integrating ideological and political education in calculus teaching is still in the stage of trial and exploration.

Calculus can cultivate students’ abstract thinking ability, logical reasoning ability, spatial imagination ability and innovation ability by making students master knowledge, methods, skills, applications, and so on, and improve students’ mathematical literacy. Calculus is a tool for human to understand nature. It is widely used in many fields such as natural science, social science, applied science, and so on. It plays an important role in the creation, transmission, exchange, and development of human culture. It has rich humanistic value and important educational value. Calculus, as an important public basic course for science, engineering, agriculture, medicine, economics, and management majors and a public elective course for other majors, has a wide and huge audience. Calculus teachers are faced with freshmen; they have a strong plasticity. Therefore, it is of great significance the research and practice integrating ideological and political education into calculus teaching.

In the domestic literature on integrating ideological and political education into calculus teaching, Luo (2019) and Shi, Feng, and Xing (2020) explored and practiced how to integrate ideological and political education into calculus teaching; Liu (2020) explored the cases of integrating ideological and political education into calculus teaching; Li and Pei (2020) took the basic theorem of Calculus as the specific case analysis object, combed the ideological and political elements in the basic theorem of Calculus from the aspects of teaching contents, knowledge background, and so on, and discussed the mode of integrating ideological and political education into mathematics teaching; Zhu, Chen, and Si (2021) explored the teaching design and practice, teaching evaluation, and reflection of ideological and political theories teaching in Calculus under the background of epidemic situation; Zhang, Jing, Li, and Wei (2020) mainly elaborated how to integrate the ideological and political education into Blended Learning of Calculus from three aspects: the orientation of ideological and political theories teaching in Calculus, the exploration of ideological and political theories teaching in Blended Learning of all courses, and the ideological and political education research of offline teaching and online teaching. The literature mainly studies the methods, approaches, cases, evaluation, and reflection of integrating ideological and political education into calculus teaching. It does not comprehensively

analyse the real reasons for the low effectiveness of ideological and political education in calculus teaching, but on the basis of careful and comprehensive analysis of the real reasons for the low effectiveness of ideological and political education in calculus teaching, there is a little literature about how to find the contents, methods, approaches, and points for attention of integrating ideological and political education into calculus teaching. For a long time, there is little integration of ideological and political education into calculus teaching, and the effectiveness of ideological and political education in calculus teaching is not high. Therefore, it is not enough the research and practice of integrating ideological and political education into calculus teaching.

This paper first carefully and comprehensively analyses the reasons for the low effectiveness of ideological and political education in the current calculus, and then puts forward the contents, methods, and approaches of integrating ideological and political education into calculus teaching on the basis, and finally finds out the matters needing attention of integrating ideological and political education into calculus teaching.

The Reasons for the Low Effectiveness of Ideological and Political Education in Current Calculus Teaching

At present, the main reasons for the low effectiveness of ideological and political education in calculus teaching are as follows.

The Characteristics of Calculus

Calculus is a branch of mathematics that studies the concepts and applications of differential calculus and integral calculus. It has high degree of abstract and tight logic. It is mainly presented in deductive inference form of systematic definitions, theorems, lemmas, corollaries, criteria. The knowledge points of the course lack the effective combination points of explicit ideology and politics; there are many contents and difficulties in calculus, but the class hours are limited, so it is difficult for teachers to take into account the ideological and political education.

The Contents and Methods of Ideological and Political Education Are Outdated

The contents of ideological and political education are out of date, which are not closely related to the current hot issues, national policy guidance, students' actual life and focus of attention, and are not attractive and infectious enough. The methods of ideological and political education are outdated. In the current ideological and political education in colleges and universities, preaching and indoctrination are the main methods, and students are in a state of passive acceptance.

Changes in the Atmosphere and Environment of Ideological and Political Education

With the changes of the times, the development of social economy and the coming of the social transformation period, the atmosphere of ideological and political education where college students have changed greatly. There are many problems among college students, such as dishonesty, lack of gratitude, lack of respect for others, and poor sense of responsibility. Many colleges and universities have not formed a perfect mechanism in the ideological and political education. Only part of the party and government cadres, the students' staff, and the teachers of "Two Courses" are engaged in ideological and political education, which has not formed the situation of joint management of the party and the government administration. The educational role of calculus teachers has not been highlighted. Many calculus teachers think that their job responsibility is to teach a good lesson and do a good job in scientific research. They only use teaching to impart theoretical knowledge, rather than impart life reasons. They are not good at digging out the elements of ideological and

political education in Calculus. This concept weakens the effect of ideological and political education and greatly reduces the main channel of classroom teaching in educating people. The recessive education role has not played out.

In today's era of economic globalization, political diversification, and cultural diversity, the introduction of active social thoughts and decadent values has a significant impact on students. Some students are wavering in value choices, show the tendency of individualism, utilitarianism, and liberalism, and lack lofty ideals and civic awareness. At present, under the influence of the socialist market economic system, people pay more attention to efficiency and interests, and their self-consciousness is constantly strengthened, which induces negative effects such as extreme individualism, money worship and hedonism to a certain extent. Young college students are very vulnerable, pay too much attention to themselves, strongly pursue personal interests, and weaken their collective consciousness. In the new era, new media such as network, wechat, and microblog are widely used, which makes information highly developed. The enrichment of information has a profound impact on the concepts of ideological and political education of college students. Due to the large number of new media in today's society, it is difficult for students to distinguish between true and false and make correct judgment.

There Is No Evaluation System Suitable for Ideological and Political Theories Teaching in Calculus

At present, the educational effect of calculus course is mainly evaluated by students' examination scores. Obviously, it is difficult to properly evaluate students' ideological and political education effect in Calculus, and ideological and political education effect in Calculus is also difficult to be tested. Most of the time, the standard for employers to select employees mainly depends on students' academic qualifications and academic achievements, but rarely considers students' ideological and political cultivation and level.

The Contents, Methods, and Approaches of Integrating Ideological and Political Education Into Calculus Teaching

Based on the analysis of the first part, this paper puts forward the contents, methods, and approaches of integrating ideological and political education into calculus teaching.

Deeply Explore the Ideological and Political Theories Teaching Elements in All Courses Contained in the Current Real Life and Social Hot Spots, and Pay Attention to the Inheritance and Enlightenment of Professional Quality, Humanistic Knowledge, and Chinese Excellent Traditional Culture, Especially the Mathematical Culture and History in Ideological and Political Education

Many concepts, methods, and so on in Calculus contain rich ideological and political theories teaching elements such as philosophic thought, values, and scientific spirit, especially the elements of dialectics. The three basic laws of dialectics (the law of unity of opposites, the law of quantitative and qualitative change, and the law of negation of negation) and the viewpoint of movement are mostly reflected in Calculus. For example, the pairs of the basic concepts of differential and integral, approximation and accuracy, finiteness and infinity, convergence and divergence, continuity and discontinuity, line and curve, constant and variable embody the law of unity of opposites. Each pair of concepts is not only the opposite of contradiction, but also interrelated and interdependent, and can be transformed into each other under certain conditions. The differential of a quantity refers to the infinite division of the quantity so that every division tends to disappear from the original quantity, that is, "breaking the whole into parts"; integral, on the contrary, is the infinite accumulation of

differential, that is, “Cumulating parts to the whole”. There is a qualitative difference between finite and infinite. In the properties of infinitesimal, the sum of finite infinitesimals and the sum of infinite infinitesimals are completely different. However, we can not only obtain infinity through finiteness, but also express finiteness through infinity. There are differences between continuous and discontinuous (discrete), but they can also be transformed into each other. Using the definition of definite integral to calculate the limit of the sequence is to transform the discrete situation into a continuous one. The method of element of calculating definite integral is to approximate the continuous quantity with discrete one. After introducing the concept of limit, straight line and curve are unified. For another example, the concept of limit and calculating the area of the circle by taking the limit of the area of the regular polygon inscribed in the circle reflects the law of quantitative and qualitative change. For another example, Calculus mainly studies variables, the idea of dynamic variables is always used in Calculus, and function is the concrete embodiment of this idea. Engels (1999, p. 132) pointed out: “Variable Mathematics—the most important part of which is calculus—is essentially nothing more than the application of dialectics in Mathematics”. The sentence reveals the essence of Calculus and highly summarize the dialectical thought in Calculus. By deeply excavating the essence of the basic concepts in Calculus and properly introducing their dialectical relations, we can help students deeply understand the concepts, cultivate students’ dialectical thinking methods, and make students receive more vivid and specific ideological education of dialectical materialism.

In the first class of Calculus, we can introduce Newton and Leibniz, the founders of calculus. In later classes, we can let students gradually understand Fermat, Rolle, Lagrange, Cauchy, etc. The rigorous and realistic attitude towards knowledge and the tireless pursuit of truth of these mathematicians will imperceptibly influence students’ life. When talking about trigonometric functions, we can introduce the outstanding contributions of mathematician Liu Hui in the Wei and Jin Dynasties and scientist Zu Chongzhi in the Northern and Southern Dynasties in China to the calculation of pi. Liu Hui used the method of cutting circle to accurately calculate pi to the third place after the decimal point. Zu Chongzhi was the first scientist in the world to calculate pi to the seventh place after the decimal point, more than 1,000 years earlier than Europeans. These introductions can greatly enhance students’ national pride and cultural self-confidence, and encourage students to strive for the development of the motherland. When teaching the concept of limit, we can use the words quoted in “Chuang tzu · Under Heaven” and Liu Hui’s cutting circle method to introduce it. “Chuang tzu · Under Heaven” quoted a saying: “The hammer of a foot is taken half of it every day, and it will never be exhausted for all ages”. This sentence contains the thought of unity of opposites, but does not consider that quantitative change to a certain extent will cause qualitative change. Liu Hui pointed out in cutting circle method that the perimeter and area of a circle are calculated by using the inscribed regular polygon in the circle. The method is that with the increase of the number of sides of the inscribed regular polygon, its perimeter (area) will be closer and closer to the perimeter (area) of the circle. Through continuous “finite segmentation” to achieve the purpose of “infinite subdivision”, so as to calculate the circumference and area of the circle, it contains dialectical ideas such as “circle and square”, “straight and curved”, “finite and infinite”, “change and invariance”, “approximation and accuracy”, “quantitative change and qualitative change”. Limit is the unity of opposites between process and result, finite and infinite, constant and variable, approximation and accuracy. In addition, limit is an infinitely close moving process, which reflects the moving essence of things. The precise definition of limit also contains the meticulous and rigorous research spirit. Through understanding the

development history of limit and teaching of this knowledge point, we can stimulate students' national pride and patriotism emotion, and let students learn the spirit of scientists pursuing excellence and perfection. When talking about continuity, we can introduce that the concept of continuity reflects a kind of stability. When the change of independent variable is very small, the change of dependent variable is also very small. In life, the changes of many things are continuous, such as the growth of plants, the transformation of temperature, the accumulation of knowledge, so we cannot be eager for success; we should be down-to-earth and follow the law. For example, learning requires a lot of time and unremitting efforts, step by step and down-to-earth. When teaching derivative, we can introduce that the process of derivation embodies the law of unity of opposites, the law of quantitative and qualitative change, the law of negation of negation, and the viewpoint of movement and change of things. The concept of derivative originated from the scientific problems that appeared in the 17th century. Many mathematicians have made meticulous research on these problems. Later, after highly summarized by scientists such as Newton and Leibniz, the concept of derivative is finally abstracted. Derivative can be applied to solve specific practical problems and is widely used in many fields such as economy, biology, medicine, and military. This philosophical thought from special to general and then from general to special makes students understand the abstract process of mathematical concepts. At the same time, it also makes students feel that mathematics often comes from real life. Only when we are good at observation and discovery, dare to try and think can we have new ideas. The definition and applications of derivative are consistent with the dialectical development process of cognition, which can encourage students to discover mathematical knowledge. When talking about high-order derivatives, it can inspire students that major changes or development are the result of the efforts of many individuals, and cultivate students' down-to-earth and persistent spirit. When teaching problems with parameters, the parameters can be regarded as both variables and constants. When talking about indefinite integral, we can reflect the process from quantitative change to qualitative change by talking about the essence of indefinite integral. When teaching the concept of definite integral, we can introduce that the limit method in definite integral embodies the law of unity of opposites, the law of quantitative and qualitative change, and the law of negation of negation; we can also make students realize that they can have great virtues only by accumulating small virtues. When talking about the mean value theorems, we can explain that they embody the unity of opposites between the local properties and the global properties of functions. When teaching the Newton-Leibniz formula, we can introduce that before it came out, there were many problems from geometry, physics, economics, engineering, and other fields, and it made these problems solved. Engels praised it as a great liberation of human spirit; we can also integrate the ideological and political element of diligent thinking, encourage students to divergent thinking, use their brains more, analyse problems from different angles, and flexibly apply the learned knowledge to solve practical problems in daily study and life. When teaching Taylor's formula, we can emphasize that we should be patient, careful, and confident and we can learn it only by overcoming difficulties, so that students can understand that to become talents needed by the society, they should not be afraid of difficulties, be serious, and do things in a down-to-earth manner. When talking about the convergence of infinite series, we can explain that it embodies the unity of opposites between finiteness and infiniteness. When teaching power series expansion, we can introduce that Li Shanlan, a mathematician in the Qing Dynasty in China, founded the power series expansion of quadratic square root, and also studied the power series expansion of trigonometric function, inverse trigonometric function, logarithmic function, etc. When talking about the calculation of double integral, we can

introduce it through the mathematical historical data “Steinmetz solid”. Zu Chongzhi and Zu Geng (a mathematician in the Northern and Southern Dynasties in China) followed Liu Hui’s thought and put forward the Zu Geng Principle when calculating the volume of “Steinmetz solid”. The discovery of the Zu Geng Principle was more than 1,100 years earlier than the similar principle in the West. When talking about the economic application of calculus, we can gradually cultivate students’ style of integrating theory with practice by cultivating students’ ability of applying mathematics. When talking about the applications of differential equations, we can introduce the famous population growth model, the Logistic Equation, which provides a powerful tool for scientists to study the propagation and development of new coronavirus.

Constantly Improve Ideological and Political Education Methods, Adopt the Ideological and Political Education Methods Close to Reality and Life, and Adapt to Students’ Personalities and Hobbies

Ideological and political education methods should keep pace with the times. In calculus teaching, we should not only pay attention to the logical process of deductive demonstration, but also consciously pay attention to strengthening morality and cultivating young persons, and constantly improve students’ ideological and political quality and stimulate students’ innovative vitality from the perspective of knowledge discovery process, calculus development history, Chinese mathematics history, mathematical beauty, etc. We should adopt the ideological and political education methods which are close to the reality and life, and adapt to the students’ personality, hobbies and growth characteristics. We should design the ideological and political education methods according to the new problems, the new focus, and the new hot spots, and use the diversified ideological and political education methods. With the help of Internet information technology, more ideological and political elements can be integrated into calculus teaching through multimedia such as intuitive pictures, videos and audio, combined with teachers’ explanations. In calculus teaching, we should combine with the actual needs, according to the different characteristics of ideological and political case analysis, situational teaching, emotional cultivation, model demonstration, reasoning and persuasion, mathematical culture and history analysis, group discussion, teaching, moral practice, and other methods, choose to use these methods pertinently, so as to improve the attractiveness and appeal to students, mobilize students’ enthusiasm and initiative, and improve students’ autonomous learning ability.

Integrate Ideological and Political Education Into Calculus Syllabus, Deep Excavate of Ideological and Political Cases in Calculus

Integrating ideological and political education into the syllabus is a necessary condition for the implementation of ideological and political theories teaching in all courses. Firstly, we should establish the curriculum teaching goal of taking ideological and political education as the core and combining knowledge teaching with value guiding, and clarify the contents of ideological and political education in the curriculum contents. Secondly, we should deeply excavate the ideological and political theories teaching elements in Calculus, integrate the ideological and political elements contained in the curriculum contents into the teaching objectives and contents of the corresponding chapters and sections, and formulate the specific ways and methods of teaching activities. We should deeply excavate the ideological and political cases in Calculus, because the monotonous knowledge explanation is far less effective than the vivid case teaching, and the teaching effect is good. On the one hand, we can carry out ideological and political education for students through vivid cases; on the other hand, we can guide students to discuss and make judgments in combination with the problems in the cases, and help students identify and establish correct values.

The Points for Needing Attention of Integrating Ideological and Political Education Into Calculus Teaching

On the basis of the first two parts of the research and practice, we find the points for needing attention of integrating ideological and political education into calculus teaching.

Improve the Acceptance of Ideological and Political Theories Teaching in Calculus

Teachers should not only constantly improve their professional quality, ideological and political cultivation and education level, but also follow the teaching law and improve the attraction of teaching and the acceptance of ideological and political theories teaching in Calculus. Teachers should strive to organically combine the knowledge, theory, and ideology of teaching contents with the acceptability of teaching methods, and constantly enhance the affinity and appeal of ideological and political education. Teachers should be rigorous and realistic, carefully prepare every class, carefully design blackboard writing, pay attention to smooth and attractive expression, teach students by using personal examples, and influence students with their own personality charm.

Grasp the Scale Well and Use the Methods Well to Integrate Ideological and Political Education Into Calculus Teaching

Teachers should grasp the scale of ideological and political education well. Because the contents of Calculus are many and abstract, they are difficult for most students. If teachers spend too much time on ideological and political education in the teaching process and ignore the teaching of the contents of the course itself, it will not only fail to achieve the purpose of ideological and political education for students, but also may have a negative effect. First of all, the contents of ideological and political education in calculus teaching should not only have pertinence and timeliness, but also adapt to the psychology of college students. Secondly, in calculus teaching, teachers should neither superficially connect calculations and proofs with ideology and politics, nor take the contents of ideological and political education as mathematical knowledge to teach, so as not to cause students' disgust and resistance; teachers should objectively introduce the knowledge of mathematical history.

Teachers should use the methods of ideological and political education well, which are close to students' reality and meet their needs. First of all, in calculus teaching, we should achieve the organic unity of "teaching knowledge" and "educating young persons"; integrating ideological and political education can neither adopt the way of "mechanically copying", nor affect the normal teaching progress. Secondly, teachers should determine the methods of ideological and political education according to the characteristics of Calculus and the actual situation of college students, and the methods should be flexible and diverse, but not subjective and arbitrary.

Reform the Examination and Evaluation Ways of Ideological and Political Theories Teaching in Calculus

Teachers can choose the appropriate examination ways of ideological and political theories teaching in Calculus, and can also establish the appropriate evaluation system of ideological and political theories teaching in Calculus. Teachers can choose the ways such as case task to exam the ideological and political theories teaching in Calculus. With the help of some softwares and platforms, through the collection of information and the analysis of big data, teachers can obtain accurate information about students' participation, teamwork, and problem-solving feedback in offline and online classes. On this basis, teachers can incorporate the cognition,

emotion, and values and other contents of students into the evaluation system to form a diversified evaluation system of ideological and political theories teaching in Calculus.

Carry Out Teaching Reflection

At present, ideological and political theories teaching in all courses is still an attempt of teaching reform, and the research and practice of integrating ideological and political education into calculus teaching is still in the exploratory stage. Therefore, teachers should carry out teaching reflection after calculus teaching, so as to improve the effectiveness of ideological and political education in calculus teaching.

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