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# Logic and Practice of Ideological and Political Thinking in Advanced Mathematics Courses

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***A*bstract:** As a fundamental course in science and engineering education at universities, advanced mathematics plays an irreplaceable role in cultivating students' logical thinking, scientific spirit, and comprehensive qualities. Integrating ideological and political education into advanced mathematics teaching is not only an inevitable requirement for achieving the goal of "three-dimensional and holistic education" but also a crucial path for promoting students' comprehensive development. This article delves into the necessary logic, practical possibilities, and real-world challenges of ideological and political education in advanced mathematics courses, systematically analyzing the implementation pathways and illustrating practical approaches through specific cases. Meanwhile, to address issues such as insufficient teacher capability, lagging resource development, disconnected instructional design, and inadequate evaluation mechanisms encountered during implementation, this article proposes practical improvement strategies. It aims to provide theoretical insights and practical guidance for the further advancement of ideological and political education in advanced mathematics courses.

**Keywords:** Advanced mathematics; Curriculum ideology and politics; Logical framework; Practical pathways

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## 1. The proper logic of ideology and politics in advanced mathematics courses

As an important part of the national educational modernization strategy, the ideological and political construction of the advanced mathematics curriculum not only embodies the theoretical value of educational reform, but also shows its practical significance in the goal of all-round education in the new era. Through the implementation of ideological and political curriculum, advanced mathematics can guide students to establish correct values and cultivate noble moral qualities while imparting subject knowledge, and become an important link in cultivating talents with both ability and political integrity in the new era.

### 1.1. Policy orientation: An inevitable requirement of national strategy

The report of the 19th National Congress of the Communist Party of China clearly pointed out that it is

necessary to "fully implement the party's educational policy and implement the fundamental task of establishing integrity and cultivating people," emphasizing that curriculum construction must be closely integrated with ideological education to achieve the "three all-round" education goals of all-stuff, all-process and all-round education [1]. As an important policy document for the ideological and political construction of curriculum, the "Guidelines for the Construction of Ideological and Political Education in College Courses" further clarifies the positioning and tasks of ideological and political curriculum, and requires all kinds of courses to consciously undertake the function of ideological and political education in the process of knowledge transmission, forming a synergistic effect of whole-curriculum education. As the core basic course of science and engineering teaching in colleges and universities, advanced mathematics should explore the ideological and political educational elements contained in it and integrate the core socialist values into the teaching of mathematical thoughts because of its subject characteristics and universal applicability. For example, the logical derivation and theoretical proof processes of mathematics can not only reflect the scientific spirit, but also cultivate students' attitude of pursuing truth and respecting facts. Through the teaching of classical problems in mathematics and demonstrating the important role of mathematics in the development of the national economy, national defense science and technology, and society, it can inspire students' patriotic feelings and sense of mission. This value guidance of "moistening things silently" is an important way to realize the national education modernization strategy.

## 1.2. Curriculum attributes: The inherent requirements of subject characteristics

As a highly logical and theoretical discipline, advanced mathematics has the characteristics of strong logic, a complete system, and wide application. It not only provides theoretical support for students to learn other subjects, but also has unique advantages in cultivating thinking ability and scientific literacy [2].

Through rigorous logical reasoning and a meticulous argumentation process, it helps students form a rigorous academic attitude and the spirit of exploring truth. For example, when teaching mathematical induction, teachers can emphasize the importance of strictly following step-by-step derivation, which is not only the embodiment of a rigorous attitude in academic research but also the shaping of a scientific spirit of being responsible for facts and pursuing truth. Many problems require students to analyze them from multiple dimensions, emphasizing the dialectical nature of problem solving. Through this process, students are able to gradually develop critical thinking and complex problem-solving abilities. The research and application of some problems often require team cooperation. Through model construction and practical teaching in advanced mathematics, students can understand the power of collective wisdom in cooperation and cultivate their cooperation consciousness and communication ability. This discipline characteristic is highly consistent with the educational goal of curriculum ideological and political education.

## 1.3. Social demand: The practical appeal for cultivating well-rounded talents

With the increasing demand for high-quality comprehensive talents in the new era society, advanced mathematics courses should not only impart subject knowledge, but also pay attention to the cultivation of students' humanistic qualities and social responsibility. This practical demand provides the impetus for the implementation of ideological and political aspects in the advanced mathematics curriculum [3]. The application of advanced mathematics in national scientific and technological progress, economic construction, and social governance is ubiquitous. For example, high-tech fields such as artificial intelligence, big data analysis, and blockchain technology are all inseparable from the support of mathematics. By integrating these application

cases into teaching, advanced mathematics courses can make students realize the importance of mathematics to national development and inspire their spirit of serving the country through science and technology. Advanced mathematics course not only helps students master professional knowledge, but also improves their logical thinking abilities and innovative consciousness. These abilities are crucial for cultivating all-round talents with an international vision, innovative spirit, and social responsibility. For example, by discussing the role of mathematical modeling in traffic management, students can realize the importance of mathematical thinking for complex system optimization, and enhance their practical application ability and professional quality.

The ideological and political construction of advanced mathematics courses closely follows the national requirements, the characteristics of discipline development, and the needs of social reality, and closely integrates discipline education with ideological and political education, which not only provides students with solid professional knowledge but also cultivates their correct values and social responsibility. By deeply digging into the ideological and political elements of mathematics curriculum, their unique role in comprehensive education can be fully leveraged, contributing to the realization of educational reform and talent cultivation goals in the new era.

## 2. The real possibility of ideological and political education in advanced mathematics courses

The realization of ideological and political education in advanced mathematics curriculum needs to be deeply explored from three aspects: the excavation of curriculum content, the innovation of teaching methods, and the optimization of teaching objectives.

### 2.1. Excavation and integration of course content

The content of the advanced mathematics curriculum contains rich ideological and political educational resources. Through appropriate excavation and integration, these resources can realize the organic combination of knowledge transmission and value guidance.

#### 2.1.1. Combination of advanced mathematical thought and philosophical education

Logical thinking and dialectics: For example, by explaining the concept of sequence limit, students can be guided to understand the "gradualness" and "leap" in the development of things, helping them understand the dialectical relationship in the change of things. This kind of thinking is helpful to cultivate students' dialectical thinking ability and enhance their ability to analyze and solve complex problems [4].

Infinity and scientific spirit: The concept of infinity and the thought of limits can be used to illustrate that the process of scientific exploration is endless, emphasizing the unceasing exploration spirit of scientists in the unknown world. For example, when discussing "$1/2 + 1/4 + 1/8 + \ldots = 1$," students can realize that infinitesimal things may also have a huge impact on the whole, extending to the relationship between individual contribution and collective development.

#### 2.1.2. Combination of advanced mathematics cases and national sentiment

Enlightenment of historical figures: In teaching, we can introduce the scientific research process of Chinese mathematicians such as Hua Luogeng, Chen Jingrun, and others. For example, Chen Jingrun's achievement of overcoming some problems of Goldbach's conjecture under the condition of scarce resources can not only inspire students to cultivate an innovative spirit, but also enhance their sense of pride in the development of

mathematics in China [5].

Practical applications and national rejuvenation: The wide application of mathematics in the field of science and technology can also serve as material for the ideological and political education curriculum. For example, by explaining the application of differential equations in spacecraft trajectory design, combined with the successful case of China's "Chang'e Project," students are guided to realize the key role of mathematics in the development of national science and technology, thereby enhancing their sense of mission.

### 2.1.3. Combination of cultural self-confidence and mathematical content

Traditional Chinese Mathematical Wisdom: Introducing ancient Chinese mathematical achievements, such as the contents of "The Nine Chapters on the Mathematical Art," can help students understand the unique contribution of the Chinese nation to the development of mathematics and enhance their cultural self-confidence. For example, when discussing the early application of the "Pythagorean Theorem" in "The Nine Chapters on the Mathematical Art," it can be combined with the derivation process of modern analytic geometry, so that students can realize the internal relationship between ancient wisdom and modern mathematical theories.

## 2.2. Innovation and optimization of teaching methods

Ideological and political curriculum involves not only the increase of content, but also the effective delivery of content to students through the innovation of teaching methods.

### 2.2.1. Situational teaching: Integrating theory into practical scenarios

Design real problem situations in the classroom and apply mathematical knowledge to practical problems. For example: Mathematical model in the epidemic situation: Taking the COVID-19 pandemic as the background, design a teaching case that uses an exponential function to predict changes in the number of confirmed cases. In the process of explanation, we can combine anti-epidemic stories to guide students to understand the importance of scientific research and their sense of social responsibility.

Mathematics and ecological conservation: When teaching the "extreme value problem" in calculus, in the context of protecting the biodiversity of a nature reserve, design the problem: How to allocate limited resources to maximize the protection of endangered species? Guide students to solve practical problems with mathematical methods, while thinking about the importance of protecting the ecological environment.

### 2.2.2. Multimedia teaching: Enhancing immersion with technology

Demonstrate practical applications of abstract mathematical concepts using virtual reality (VR) techniques. For example, when explaining curve length in calculus, use mathematical modeling software [6] to show the approximate length calculation of the Great Wall, which enhances students' sensory experience and makes them intuitively understand the practical significance of mathematics.

### 2.2.3. Problem-oriented teaching: Promoting teamwork and independent thinking

The problem-oriented teaching method (PBL) is used to allow students to design mathematical models around social issues. For example, the topic of "Optimization of Public Transport in a City" is put forward, and students are asked to model and calculate the optimal distribution location of bus stops in groups. This way can not only improve students' ability to solve problems, but also guide them to pay attention to social issues.

### 2.3. Diversified expansion of teaching objectives

Advanced mathematics curriculum should be expanded from knowledge imparting to ability cultivation and value guidance, so as to achieve the goal of students' all-round development.

#### 2.3.1. From rigorous scholarship to value guidance

Rigorous academic attitude: The reasoning process of advanced mathematics emphasizes logic and standardization, and cultivates students' rigorous academic attitude through strict proof procedures. For example, when explaining mathematical induction, we can emphasize the importance of "one mistake and the whole is wrong," and guide students to pay attention to details and processes in their study and work. Values guidance: Through the explanation of the history of mathematics, students realize that scientific research needs not only intellectual support, but also morality and perseverance. For example, introducing Hua Luogeng's persistence in research during the War of Resistance Against Japanese Aggression can illustrate the importance of the power of science to the country and the people.

#### 2.3.2. From professional ability to social responsibility

Social responsibility: By explaining the "multi-objective optimization" problem in optimization theory, students are guided to consider the balance of multiple interests when solving practical problems. For example, designing an optimization case that includes environmental protection and economic development can help students recognize the role of mathematics in sustainable development. Awareness of innovation: Through the discussion of open-ended questions, students are encouraged to explore the application of mathematical theory in new fields. For example, let students try to discuss big data versus mathematical modeling methods in machine learning.

## 3. Practical challenges of ideological and political education in advanced mathematics courses

Although ideological and political education in advanced mathematics curriculum has become an important direction of educational reform, it still faces many challenges in theoretical exploration and practical implementation, mainly reflected in teachers' quality, teaching resources, curriculum design, and evaluation mechanisms.

### 3.1. Insufficient quality of teaching staff

Advanced mathematics teachers pay more attention to knowledge transfer and ability cultivation in traditional teaching, but have insufficient understanding of the connotation and goals of curriculum ideological and political education, which leads to obvious obstacles in the promotion of curriculum ideological and political education.

#### 3.1.1. Lack of ideological and political awareness of the curriculum

Some teachers think that advanced mathematics is a highly logical and formal subject, which is difficult to combine with ideological and political education. They tend to separate mathematics from "values," and even worry that integrating ideological and political curriculum into mathematics teaching will weaken the rigor of professional teaching. This kind of perception limits the expansion path of curriculum ideology and politics, which makes it difficult for teaching content to go beyond knowledge itself and to tap the potential of

curriculum ideology and politics.

### 3.1.2. Low ideological and political education abilities

Most mathematics teachers lack the professional background of ideological and political education, and lack methods on how to organically integrate ideological and political elements into the classroom. For example, when teaching mathematical theories, even if they quote historical stories or social application cases, they often remain at the level of simple knowledge supplementation and fail to dig deep into their educational value. For example, when explaining the application of calculus, teachers mention Einstein's theory of relativity, but do not further elaborate on the important role of mathematics in promoting the boundary of human cognition, which leads to students' superficial understanding of curriculum ideology and politics.

## 3.2. Insufficient construction of teaching resources

The construction of ideological and political education resources in advanced mathematics curriculum lags behind other disciplines, and the existing resources are difficult to meet the classroom needs, which becomes a restrictive factor of ideological and political practice in the curriculum.

### 3.2.1. Lack of systematic ideological and political education case resources

At present, the case development of ideological and political in advanced mathematics curriculum mainly depends on teachers' personal efforts, lacking systematicity, authority, and sharing. For example, the resources of mathematical thoughts, historical events, practical applications, etc., have not yet formed a unified case base, and it is difficult for teachers to find specific materials that meet the curriculum objectives. The lack of case resources directly leads to teachers' inability to integrate profound ideological and political elements into the curriculum, and the curriculum thinking is fragmented, making it difficult to form a systematic value guidance.

### 3.2.2. Outdated textbook content

Most advanced mathematics textbooks still focus on the traditional knowledge system and fail to fully integrate the content of ideological education. For example, textbooks rarely mention the achievements of Chinese mathematicians in the field of international mathematics, and it is difficult for students to feel the important role of mathematics in national development from the textbooks. Taking the "Advanced Mathematics" textbook as an example, the contributions of Western mathematicians such as Newton and Leibniz are generally the main topics, and the introduction of Chinese traditional mathematics and its modern achievements is ignored, which weakens the patriotic education of the curriculum to some extent.

## 3.3. Disconnect between curriculum design and implementation

The design and implementation of ideological and political education in advanced mathematics courses have not been able to realize the effective connection between theory and practice, which is manifested as formal and superficial problems.

### 3.3.1. Disconnection between content and ideological and political goals

Some ideological and political practices in courses pay too much attention to theoretical logic and ignore students' actual acceptance ability. For example, some teachers simply link mathematical formulas with patriotic feelings, but fail to organically link them through in-depth analysis. This disconnection makes the ideological and political education curriculum formal and empty, and it is difficult for students to really resonate. The

content of the course lacks internal logic and vividness, which leads to the ineffective realization of ideological and political goals, and students have a low acceptance of ideological and political education in the course.

### 3.3.2. Mismatch between teaching methods and the characteristics of the mathematics subject

In the course of ideological and political implementation in advanced mathematics curriculum, some teachers still use the traditional teaching method, ignoring the interaction and participation of students [2]. For example, when teachers explain mathematical models, they pay more attention to the calculation results instead of guiding students to discuss the social significance behind the models. For example, the teacher conducted a course on the theme of "Calculus and Ecological Protection," but the whole course was mainly taught by the teacher. Students were only required to follow the teacher's calculation steps, and failed to feel the actual value of mathematics in ecological protection through practical experience.

## 3.4. Imperfect evaluation mechanisms

The evaluation of the ideological and political education effect of the curriculum is an important link to promote its implementation, but the current evaluation mechanism of the advanced mathematics curriculum has the following shortcomings.

### 3.4.1. Single evaluation content

At present, the evaluation of advanced mathematics courses is still centered on knowledge and ability, and there is a lack of comprehensive evaluation of the improvement of students' ideological and political qualities. For example, course assessment usually focuses on problem-solving abilities and calculation skills, while ignoring the growth of students' sense of responsibility and social commitment. The unity of evaluation content makes teachers and students pay more attention to knowledge acquisition, weakening the importance of ideological and political education, and making it difficult to stimulate students to pay attention to ideological and political education in the curriculum.

### 3.4.2. Lack of scientificity in evaluation methods

The existing evaluation methods often stay in the qualitative evaluation stage, lacking quantitative indicators. For example, there are no clear standards on how to measure the change of students' values and the improvement of social responsibility, which leads to the fact that the evaluation results cannot truly reflect the implementation effect of curriculum ideological and political education in the course. For example, teachers try to evaluate the ideological and political effect of courses through classroom feedback questionnaires, but the questionnaire questions are too general, such as "Do you feel that there is ideological and political education content in the course?" which leads to students' superficial answers and unable to provide substantive reference.

# 4. Conclusion

The construction of ideological and political education in the advanced mathematics curriculum is the concretization and practical application of curriculum ideological and political ideas in science and engineering teaching. By excavating curriculum content, innovating teaching methods, and optimizing evaluation systems, advanced mathematics curriculum can realize value guidance while imparting knowledge, and make contributions to cultivating innovative talents with all-round development in the new era. The realistic challenges of ideological and political education in advanced mathematics curriculum show that in order to

achieve the ideological and political goal of the curriculum, it is necessary to systematically promote it from the aspects of teacher training, resource construction, optimization of teaching methods, and improvement of evaluation mechanisms. Overcoming these challenges will help fully leverage the educational function of curriculum ideology and politics and provide strong support for talent cultivation in the new era.

## Disclosure statement

The authors declare no conflict of interest.

## References


[1] People's Daily Online, 2016, Xi Jinping Emphasized at the National Conference on Ideological Work in Colleges and Universities: Incorporate Ideological Work Throughout the Entire Process of Education and Teaching, and Create a New Situation in the Development of Higher Education in My Country, viewed September 15, 2022, http://politics.people.com.cn/gb/n1/2016/1209/c1001-28936072.html

[2] Li D, 2023, Exploration of Ideological and Political Construction in Higher Mathematics Curriculum. Teaching Reference of Politics in Middle Schools, (34): 92–93.

[3] Zhang P, 2023, Mining Strategies of Ideological and Political Elements in Advanced Mathematics Teaching. Theory and Practice of Education, 43(18): 48–50.

[4] Yang B, 2024, Research on Teaching Reform and Practice of Higher Mathematics Curriculum under the Background of Ideological and Political Curriculum. Journal of Jiamusi Vocational College, 40(11): 119–121.

[5] You H, 2024, Research and Exploration on the Ideological and Political Construction of "Advanced Mathematics" Course Integrated into the History of Mathematics. Education Teaching Forum, (18): 149–152.

[6] Pan W, 2024, Exploration of Ideological and Political Construction and Teaching Reform of "Advanced Mathematics" Course under the Background of "Innovation-Driven." Journal of Mudanjiang University, 33(10): 73–78.