Modern algebra curriculum ideological and political case

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Abstract: Strong "abstractness" and strict "logic" are the two major characteristics of modern algebra. The article combines the characteristics of the curriculum, takes "the Guiding Outline of ideological and political construction of the curriculum in colleges and universities" as the guiding ideology, and takes "the ideological and political education of science and technology should be combined with the cultivation of scientific spirit in the course teaching, so as to improve the students' ability to correctly understand the problem, analyze the problem and solve the problem" as the goal. The article introduces the corresponding ideological and political cases from the five points of "mathematical beauty" in the three algebraic systems of group, ring and domain, the development history of modern algebra, the frontier application of modern algebra, the integration of modern algebra with other disciplines, and the dialectical materialism thought in logical argumentation.

Key words: modern algebra; Curriculum thinking and politics; Discipline integration

1. The importance and difficulty of integrating "Modern algebra" into ideological and political elements

The Guiding Outline of Ideological and Political Construction in the Curriculum of Colleges and Universities points out that the fundamental issue of education is who to train, how to train and for whom to train, and the effectiveness of cultivating people is the fundamental standard for testing all work in colleges and universities. To carry out the fundamental task of cultivating people by virtue, we must integrate value shaping, knowledge imparting and ability cultivation into one and cannot be separated. The ideological and political elements should be integrated into knowledge imparting and ability cultivation to help students shape a correct world outlook, outlook on life and values, so as to achieve full and all-round education. In the new era, it is becoming more and more important to integrate ideological and political elements into the modern algebra course. First of all, the channels for students to obtain information are becoming more and more diversified. Through learning, students can master the law of the development of things, understand the principles of the world, enrich their knowledge, increase their insight, and shape their character. Only in the rich social information can they obtain correct thoughts and establish a correct outlook on life. Secondly, the world situation is changing rapidly, political identity, family feelings are the premise of becoming a socialist builder and successor with all-round development of morality, intelligence, body, the United States and labor, ideology and politics into the classroom, can imperceptibly strengthen students' ideals and beliefs, and cultivate students' patriotic sentiment of loving the Party, loving the country, loving socialism and loving the people. Moreover, modern algebra, as a professional course for mathematics majors, is also a subject with strong application. In teaching, emphasis should be placed on the training of scientific thinking methods and the education of scientific ethics, so as to cultivate students' sense of responsibility and mission to explore the unknown, pursue the truth and climb the scientific peak, so as to cultivate students' spirit of excellence as craftsmen of a great country. Inspire students to serve the country with science and technology feelings and sense of mission.

The ideological and political education of science and technology discipline should be combined with the training of scientific spirit in the course teaching, so as to improve students' ability to correctly understand, analyze and solve problems. Modern algebra mainly cultivates students' ability of logical thinking and abstract thinking. Strong "abstractness" and strict "logic" are the two major characteristics of this course. The main content of modern algebra is the basic definition and basic nature of the three algebraic systems of group, ring and field. The definition involved in the course is more abstract, and the logic of proposition proof is stronger. Students have considerable difficulty in understanding the definition when learning the course knowledge, and it is even more difficult to understand the proposition and make logical argument. Even if some students have strong logical ability and abstract thinking ability, in the face of boring pure mathematical theoretical knowledge, they may have the idea of "what's the use of learning", thus losing their interest in learning. How to overcome the difficulty of modern algebra course and naturally integrate ideological and political elements is a big problem faced by modern algebra teachers. It is an effective way to solve this problem by combing the algebraic structure of group, ring and domain algebraic systems, understanding the history of modern algebra development, combining the application of modern algebra in frontier science, mining the ideological and political elements of the curriculum, and naturally integrating "flavored" ideological and political elements in appropriate knowledge points.

2. The case of thinking and politics in modern algebra course

Only the proper organic integration of professional courses and ideological and political content can achieve the effect of bacon casting soul and enlightening the mind. In the course ideological and political teaching design, we should follow the law of ideological and political work, the law of teaching and educating people and the law of students' growth. The effective integration of ideological and political elements into the curriculum, first, the integration should be natural and reasonable, to achieve the silent penetration of things, natural organic extension, seamless seamless integration, can not be for the sake of ideological and political education, forcibly grafting

some ideological and political education content into the subject teaching, far-fetched rote and tough indoctrination, which is easy to cause ideological and political elements and subject knowledge out of line. The effect will backfire. Second, ideological and political elements and curriculum content should be rigorous and appropriate, not ambiguous or inaccurate. Third, the beauty lies in the finishing touch, a lesson, a teaching link in the end into how many ideological and political elements are appropriate? In real life, moral norms, philosophical principles and human principles are everywhere, and many things can be linked with academic education, but the more the better, the better. Only when the ideological and political elements are used properly and appropriately in discipline teaching, can they play the role of finishing the finishing touch at critical points in order to achieve effective ideological and political education. Combining with the characteristics of modern algebra curriculum, this paper introduces the corresponding ideological and political cases from the five points of "beauty of mathematics" in the three algebraic systems of group, ring and domain, the development history of modern algebra, the frontier application of recent generations of mathematics, the integration of modern algebra and other disciplines, and the cultivation of dialectical materialism in logical argumentation.

Case 1 The definition of a group of cases leads students to understand the "symmetry beauty" of the binary operation of a group

In the lesson "Definition of a Group", the teacher first clarified the meaning of group theory: to measure the symmetry of things. Using this as a starting point, we designed appropriate ideological and political elements to guide students to understand the "symmetry beauty" of the binary operation of groups. For example, the video of "20211202 Complete symmetry of the symmetrical beauty of the motherland" is inserted in the PPT to show the beauty of symmetry in the great rivers and mountains of the motherland, as well as the famous buildings with the beauty of symmetry, and introduce the importance of group theory: wherever there is symmetry, there is the existence of groups. Through the video, students appreciate the beauty of the mountains and rivers of the motherland, cultivate students' patriotism, and make it clear that the main feature of the binary operation of the algebraic system is symmetry. After that, students were asked to summarize the commonness and abstract the definition of a group by taking the examples of the sets and their binary operations that meet the definition of a group. From the "known to unknown" teaching method, students can gain new knowledge from existing knowledge, implement the "student-centered" education concept, improve students' ability to correctly understand and analyze problems, comprehend the simplicity of mathematical expression, appreciate the beauty of mathematical operations, improve the discipline aesthetic, and initially understand the meaning of "measuring the symmetry of things" of groups. At the same time, cultivate students' dialectical thought of Marxism: all things in the world are universally connected. Finally, in the extension after class, students are asked to read the literature about the application of group theory in cutting-edge science and understand the importance of group theory. By combining the boring basic theory with application, the students know that "learning is applied" and further understand the meaning of "measuring the symmetry of things" of groups.

Case 2 The case two Rings and the Definition of Ideal guide students to understand the contributions of domestic and foreign mathematicians in the recent development of algebra

In the lesson of "Common Types of Rings", the definition of residual rings is introduced by the famous "China Residual Theorem". While clarifying their learning objectives, students can understand the contribution of Chinese mathematicians in the history of mathematics development, enhance national pride, stimulate learning interest and resolve to serve the country with science and technology. In the lesson of "Ideal and Quotient Ring", the origin of the definition of "ideal" is introduced. The word "ideal" was proposed by Kummer when he studied the "decomposition of prime factors" on algebraic integer rings. Later, it was developed by many mathematicians and rich research results on ideal have been obtained. Which eventually led to the development of module theory and ideal theory. The purpose of this design is to let students understand the process of establishing mathematical knowledge, understand the anecdotes of mathematicians, understand that the establishment of mathematical results is not overnight, any success is after thousands of hardships, to overcome difficulties, mathematicians have never stopped the pace of pursuing the truth, in order to stimulate students' thirst for knowledge, encourage students to work hard, Train students in the pursuit of truth on the road to be fearless of difficulties, active exploration, assiduous study, the courage to innovate the scientific spirit.

Case 3 The basic definition of three group homomorphisms in the case guide students to understand the application of group theory in quantum mechanics

In the lesson of "Basic Theorem of Group homomorphism", first of all, after the basic properties of group homomorphism, the theoretical significance of group homomorphism is introduced: group homomorphism can maintain some properties of groups, establish homomorphism of abstract groups to familiar groups, which is helpful to explore the structure of abstract groups and realize the transformation from abstract to concrete. Making good use of the transformation idea can enable students to grasp the definition of group more deeply, find the relationship between groups, understand the meaning of group homomorphism, and improve students' ability to solve and analyze problems. Secondly, I will do two points of extended reading after class. One is to understand the main line of group representation theory: establishing homomorphic mappings of invertible linear transformation groups or invertible matrix multiplicative groups from groups to linear Spaces, and transforming the study of abstract groups to the latter two groups. The second is to understand that group representation theory is the theoretical basis of quantum mechanics, and to deeply understand the importance of group theory. Apply theory to practice, stimulate students' thirst for knowledge, and add some "fun" to boring theoretical learning.

Case 4 Lagrange's Theorem Proving "Fermat's Little Theorem" in elementary number theory

In the lesson "Cosets of subgroups", we introduce the important position of Lagrange's theorem in group theory, and introduce Fermat's little theorem is one of the four theorems of elementary number theory (Wilson's theorem, Euler's theorem in number theory), the

Chinese residual theorem (also known as Sun Tzu's theorem), Fermat's little theorem), which has a very wide and important application in elementary number theory. The application of Lagrange's theorem can be directly derived Fermat's little theorem. This case is an example of the application of group theory to other disciplines of mathematics, demonstrating that group theory provides important theoretical support for other disciplines. Through this case, students can realize the close connection between group theory and other disciplines, stimulate students' learning interest and confidence, and at the same time, students can understand the status of "China's residual theorem" in elementary number theory, and enhance their national pride.

Case 5 introduces the geometric significance of cubic symmetry groups

In the lesson of "Symmetry Group", we introduce that the cubic symmetric group is the smallest non-commutative group in group theory, and show that the geometric meaning of the cubic symmetric group is "the group composed of all symmetric transformations of equilateral triangles about transformation synthesis", which is introduced by mathematician Hua Luogengzeng's famous saying: "The combination of numbers and forms is good, and everything is separated." . In this case, the abstract group is transformed into a group with great geometric intuition. While learning about the interesting life of Chinese mathematicians, students can deeply understand the cubic symmetry group through geometric intuitive abstraction, and realize that abstract and concrete intuition are not only relative, but also closely related. The combination of abstract thinking and image thinking can simplify complex problems and make abstract problems concrete. In extension after class, students are guided to read the application literature of symmetry groups in atomic materials, understand the development of frontier science and technology and the value of recent generations of mathematics, guide students to pay attention to the information of The Times, keep pace with The Times, and stimulate their interest in learning.

Case 6 Introduces the definition of generator by analogy with the value of individual to society and the meaning of generator to group

In the lesson of "Cyclic Groups", by analogy with the value of individuals to society and the meaning of generators to groups, the definition of generators is introduced to guide students to work hard to create the maximum value of their individual abilities, make contributions to society, and deeply understand the meaning of generators. This design combines Marxist standpoint and scientific spirit, and organic integration of algebraic knowledge and socialist core values to improve students' ability to correctly understand, analyze and solve problems. The organic combination of ideology and politics with the course content, maximize the modern algebraic education function, successful teaching design is one of the effective links. A successful ideological and political teaching design requires teachers to have certain professional ability and understand the modern algebra knowledge system and the history of the subject; Have a certain mathematical vision and mathematical literacy, through the abstract algebraic structure of the appearance of its truth, goodness and beauty; Understand current affairs and politics, pay attention to social development, and understand the frontier application of disciplines; Have certain dialectical thinking ability; In-depth study of the relationship between modern algebra and other disciplines. Successful ideological and political teaching should dig deep into the ideological and political elements contained in modern algebra, combine Marxist standpoint and scientific spirit, and organically integrate algebra knowledge with socialist core values, improve students' ability to correctly understand problems, analyze problems and solve problems, and help students establish correct outlook on life, world outlook and values.

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