Research on Higher Mathematics Teaching Reform Incorporating Ideological and Political Elements in the Course——Take the Concept of Constant Term Series as an Example

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ABSTRACT

This article follows the education concept of "student-oriented, application of learning, and comprehensive development", and gradually promotes the "three integration + two improvement" of higher mathematics teaching. This is the integration of teaching content and mathematics culture, the integration of knowledge transfer and value shaping, the integration of online and offline teaching modes. This can improve students' mathematics literacy and application ability in both directions. Curriculum design is carried out through the idea of "introducing, investigating, speaking, discussing, practicing, and exploring" to gradually realize the organic unity of knowledge transfer and value guidance.

Keywords: Advanced mathematics, curriculum ideology, teaching design, evaluation system

1. INTRODUCTION

Since 2004, the central government has successively issued documents on further strengthening and improving the ideological and moral construction of minors and the ideological and political education of college students [1]. In 2014, the concept of "Curriculum Ideology" was proposed. Curriculum ideological and political is to construct a pattern of educating people for the whole staff, the whole process, and the whole course, and the various courses and the ideological and political theory courses are in the same direction to form a synergy effect [2]. It regards "fostering integrity and promoting rounded development of people" as a comprehensive educational concept of the fundamental task of education. In June 2020, the Ministry of Education of the People's Republic of China issued the "Guiding Outline for the Ideological and Political Construction of Curriculum in Higher Education Institutions". It clearly points out that ideological and political education should run through the talent training system, comprehensively promote the ideological and political construction of college courses, give full play to the educating role of each course, and improve the quality of college talent training. Advanced mathematics is a public basic course for undergraduates majoring in science and engineering. Therefore, to give full play to the educating role of higher mathematics courses, make them go in the same direction as ideological and political courses, build a long-term mechanism for cultivating people,

and realize all-round education for all employees. It is a question worthy of our consideration.

2. CURRICULUM IDEOLOGICAL AND POLITICAL TEACHING DESIGN

On the premise of keeping the teaching content of higher mathematics course unchanged, fully excavate the inherent philosophy and application value of the course, and apply it to the classroom teaching, so as to achieve the goal of ideological and political education. The instructors closely focus on the training goals of various undergraduate professionals, and strive to continuously explore the ideological and political elements of the curriculum from the perspectives of mathematical knowledge, mathematical culture, anecdotes of famous mathematical experts, mathematical development history, mathematical modeling ideas. Combining the characteristics of higher mathematics education and teaching, give full play to the educating function of higher mathematics courses, and gradually improve cultural quality while improving mathematics knowledge and ability [3]. It combines knowledge transfer with value guidance, so that students can understand the world scientifically and have the methods and abilities to transform and create the world. Realize the unity of education, teaching, knowledge and action [4].

The ideological and political case design of this course takes the "Concept and Nature of Constant

Term Series" in Advanced Mathematics as an example. It has always adhered to the education concept of "student-oriented, applied learning, and comprehensive development", and gradually promoted the "three integration + two improvement" of higher mathematics teaching. This is the integration of teaching content and mathematics culture, the integration of knowledge transfer and value shaping, and the integration of online and offline teaching modes, which can improve students' mathematical literacy and application ability in both directions.

2.1. Ideas and Thoughts of the Reform of Ideological and Political Education

The content involved in this case is one of the important content in this textbook, and the ideological and political element adopted is the classic Zeno's paradox—the problem of Achilles chasing the tortoise. The case is designed through the idea of "citing, investigating, speaking, discussing, practicing, and exploring". The specific process is: creating scenarios (Zeno's paradox) to elicit problems, collecting and consulting to discover problems, group discussion to explore problems, inspiring and guiding problem solving, consolidating exercises, deepening understanding, and summarizing and thinking. These teaching modules can fully mobilize the subjective initiative of students, so that the curriculum teaching content and ideological and political elements are integrated, and the moral education content contained in mathematics is naturally and harmoniously integrated into classroom teaching, which helps guide students to establish correct dialectical materialism And the study habits of scientific thinking, gradually improve students' mathematics quality and the ability to apply mathematical knowledge to solve practical problems [5].

2.2. Teaching methods and methods

2.2.1. Theory teaching

Teachers are student-centered and follow the teaching principle of "student-oriented-action-oriented-learning for application", "integrate" teaching content, "decompose" teaching resources, and adopt an online + offline hybrid teaching model to make Students can choose learning resources according to their own needs and learn independently with questions.

2.2.2. Case teaching method, heuristic teaching

In classroom teaching, teachers use the case teaching method as the "one main line", organize teaching in the mode of "case introduction-new teaching

explanation-return to case-problem solving", and put forward targeted teaching questions to guide students to think effectively.

2.2.3. Group discussion

Teachers organize student groups to discuss in-group and complete learning tasks together, so as to continuously deepen students' understanding of teaching content and gradually cultivate students' inquiry ability and problem-solving ability.

2.3. The design of teaching links and the organization and implementation of teaching process

2.3.1. The instructor assigns pre-class tasks, and students consult relevant materials

The instructor groups the students before class, assigns pre-class tasks, and looks up Zeno's paradox—the story of Achilles chasing the tortoise. Students work in groups to look up relevant information, understand the background of the story, and discover paradox problems.

2.3.2. Creating scenarios in class leads to questions

Achilles is the best runner in Homer's epic. Supposing Achilles races with the tortoise. If the tortoise is allowed to run a distance l_1 first, then when Achilles runs to the end point l_1, the tortoise will pass the distance l_2. When Achilles ran to finish l_2, the tortoise passed the distance l_3 again. By analogy, the tortoise always goes some distance ahead of Achilles. Therefore, the ancient Greek philosopher Zeno believed that Achilles would never catch up with the tortoise. When the case was introduced, the instructor used PPT animation to demonstrate the process of Achilles chasing the tortoise vividly, enabling students to intuitively understand the mathematical problems described by the paradox, attracting students' attention, and motivating students to solve problems. Secondly, gradually raise doubts, guide students to analyze, help students think about the key points and methods of solving problems, and deduced that the distance Achilles took to chase the tortoise is $l_1 + l_2 + l_3 + \cdots + l_n + \cdots$. This will pave the way for the new lesson.

2.3.3. Group discussion

From the distance Achilles chased the turtle, we can see that it is the "sum of infinite items". From this, we can conclude the definition of the constant term infinite series, and gradually analyze the concept of convergence and divergence of infinite series. Students are divided into groups to discuss, guide students to discover and analyze problems, and independently explore the breakthroughs in solving problems. When discussing the concept of convergence and divergence of the constant term infinite series, we should pay attention to using the known knowledge of the finite sum and the limit of the sequence as a pavement, and analyze the first N sections of distance Achilles ran when chasing the turtle. Teachers should guide students to use the knowledge in high school to calculate the sum of their antecedents, and then use the limit idea to extend to the limit of the sum of the preceding sections, and use the limit of the partial sum sequence to judge whether the sum of the infinite items exists. Teachers use new and old knowledge to connect with each other, and let it happen naturally, that is, the method of judging the convergence and divergence of constant term series, which conforms to the students' cognitive law, and helps students grasp the essence of the problem through in-depth analysis of concepts.

2.3.4. Inspire and guide problem solving

The teacher puts forward two simple and representative examples for students to discuss, and gradually guides students to summarize the conclusion of judging the convergence of the series, and use this judgment to completely solve Zeno's paradox, and give a rigorous mathematical explanation to it . Let the speed be v_1 and v_2 respectively, $l_3 = l_2 \cdot \dfrac{v_2}{v_1}$,

$$\cdots l_n = l_{n-1} \cdot \frac{v_2}{v_1}, l_2 = l_1 \cdot \frac{v_2}{v_1},$$

Because of $\dfrac{v_2}{v_1} = q(q < 1),$ so

$$s_n = l_1 + l_2 + l_3 + \cdots + l_n$$

$$= l_1 + l_1 \cdot q + l_1 \cdot q^2 + l_1 \cdot q^{n-1} = \frac{l_1(1-q^n)}{1-q},$$

And because of $q < 1,$ so $\lim\limits_{n\to\infty} s_n = \dfrac{l_1}{1-q}\cdot.$, so Achilles ran the distance $l_1 + l_2 + l_3 + \cdots + l_n + \cdots$

$$= \frac{l_1}{1-q}.$$

Teachers let students use mathematical thinking to gradually solve practical applications, deepen their understanding of mathematical knowledge, and feel the value of mathematical applications. At the same time, students verified the error of Zeno's paradox from a scientific perspective, and gradually revealed the dialectical relationship between motion and stillness [6].

2.3.5. Consolidate exercises to deepen understanding

Arrange two exercises, one is verification $0.\dot{3} = \dfrac{1}{3}$, and the other is that the ball falls freely from a height of one meter, and the height of each jump is reduced by half. Ask whether the ball will stop moving at a certain moment? Through the knowledge learned in this lesson, establish the sum of infinite items, and then take the limit to get the final result. By solving practical problems, students can experience the joy of applying what they have learned and are good at analyzing and solving problems with scientific thinking habits in real life.

2.3.6. Summing up and thinking about quality development

On the one hand, it summarizes the main content and knowledge points of the course, and emphasizes the understanding of the concept and nature of the convergence and divergence of the constant term series and the mastery of the judgment of the convergence and divergence of the geometric series. On the other hand, I arrange the after-school quality development work related to practical applications: the origin of the Koch snowflake curve and the calculation of its perimeter and area. This allows students to use the knowledge they have learned in class to solve practical problems, and at the same time encourages student group cooperation and seeks solutions by consulting related materials, gradually enriching students' math culture and improving mathematics literacy.

2.4. Evaluation method

We combine the school's undergraduate talent training program, organically integrate the curriculum ideological and political concepts, and establish a curriculum ideological and political teaching effect evaluation system. We reform the evaluation methods of students' curriculum learning, and incorporate the teaching goals of value guidance, knowledge transfer, and ability training into the students' curriculum learning evaluation. Teachers account for 20% of the

curriculum ideology and politics in the process assessment, and 20% of the comprehensive application questions are set in the summative assessment to continuously improve the comprehensive quality of students.

3. TEACHING REFLECTION

This teaching design teacher starts from examples, collects materials before class, derives and analyzes problems in class, and solves problems after class. The teacher introduces new knowledge from the problem, solves the problem by the new knowledge, deepens the essence of the problem, and then applies the essence to the actual problem, forming a closed loop to help students deepen their understanding of knowledge. At the same time, teachers make full use of modern information technology, using heuristics, inquiry, group cooperation and other methods to advance layer by layer to deepen their understanding of theory.

Aiming at the organic unification of value guidance and knowledge transfer, integrating the ideological and political elements of the curriculum, while improving students' political accomplishment, it also gradually strengthens the ideological and political qualities of the teachers themselves. Teachers integrate political knowledge, ethics, morality, and other ideological and political education into classroom teaching to guide students to adhere to the correct political direction and value pursuit, establish correct outlook on life and values, enhance family and country feelings, and enable students to have good scientific literacy And meticulous craftsman spirit. At the same time, as the implementer of curriculum ideology and politics, teachers should improve their own political literacy through a variety of learning methods, continuously strengthen the basic construction of curriculum ideology and politics, educate and edify students in various ways, and give full play to the function of curriculum education.

4. CONCLUSION

4.1. Contribute to the realization of personalized, efficient and interactive advanced mathematics classrooms

Teachers use information-based teaching methods and network teaching platforms to transform from "teaching first and then learning" to "learning first and then teaching, teaching by learning". First of all, teachers introduce the world classic Zeno's paradox to increase students' interest in learning; secondly, teachers can make full use of student-student discussions, teacher-student collaboration to explore

problems, complete learning tasks, and improve students' learning autonomy through layered doubts and gradual guidance. Sex, enthusiasm, to achieve more interaction between teachers and students, so as to achieve efficient classroom teaching.

4.2. Contribute to the integration of knowledge transfer and value guidance

By tapping the ideological and political resources of mathematics courses, teachers integrate knowledge transfer, ability training, and ideological guidance into the whole course of teaching to achieve the goal of comprehensive education and achieve the consistency of ideological and political education goals and the needs of students' growth and development. Teachers unify the knowledge of mathematics teaching, while teaching and learning mathematics knowledge, ideological and political education for students. At the same time, this can change the teaching concepts and teaching habits that teachers have formed over the years, improve the awareness of education, and truly "love students, be knowledgeable, be able to teach, and be an example."

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