

An Analysis of the Integration of Mathematical Culture into Curriculum Ideological and Political Education

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Abstract: In order to promote the effective development of the curriculum ideological and political education of college mathematics, it is really necessary to explore the methods of integrating mathematical culture into the curriculum ideological and political education of mathematics. This paper analyses the potentials and strategies to integrate curriculum ideological and political education with mathematical culture. It mainly adopts the measures such as carrying out ideal and belief education when imparting mathematics knowledge, establishing the mathematics contest platform to create a mathematical cultural atmosphere, and using mathematical concepts and mathematical allusions to guide students to form correct outlook and sense of value and further form excellent humanistic qualities. It shows that both teachers and students need to investigate the significance of exploring the mathematical spirit in the teaching and learning activities. It is of great significance to develop curriculum ideological and political education, explore the ideological and political elements embedded in mathematical culture and implement the ideological and political construction of mathematics.

1. Introduction

The comprehensive reform of “Three Comprehensive Education” is a strategic measure to strengthen and improve the ideological and political education of colleges and universities under the new situation, and to fully implement the fundamental task of cultivating people with morality [1]. Colleges and universities have implemented the reform of “Three Comprehensive Education” based on all-round education, focusing on cultural influence and insisting on the education of human beings, so that college students’ daily life is rich and meaningful [2]. It is necessary to build ideological and political courses and fully explore the ideological and political elements embedded in mathematical culture, so as to deeply implement the ideological and political construction of mathematics courses in colleges and universities.

2. Significance of Integrating Mathematical Culture into Curriculum Ideological and Political Education

Curriculum ideological and political education is based on the idea of educating people. A new

concept and model of ideological and political education in colleges and universities is committed to improving students' ideological level, political awareness, moral quality, and cultural literacy. Mathematics is the basis of science, and its prosperity often determines the progress or decline of the society [3]. What's more, college mathematics is one of the basic courses with higher academic credits and teaching hours for college science and engineering students. Therefore, it should not be absent in the curriculum ideological and political education. However, college mathematics courses have their own characteristics, despite of their significant differences with other science and engineering courses and even humanities and social science courses. It is not easy to effectively carry out the curriculum ideological and political education within mathematics courses [4]. Therefore, in order to promote the effective development of the curriculum ideological and political education of advanced mathematics, it is really necessary to explore the path and methods of integrating mathematical culture into the curriculum ideological and political education of mathematics [5].

3. Practical Strategies to Integrate Mathematical Culture into Curriculum Ideological and Political Mathematics Education

3.1. Ideal Belief Education in the Process of Imparting Mathematical Knowledge

Mathematical principles, formulas and other similar concepts have finally come into being by trial and error. Students need to really comprehend and grasp the core meanings of the knowledge and the relationship between them. Teachers will also explain the origin, and development of the knowledge system while imparting the knowledge. China has a long history and deep cultural connotations. Many mathematical concepts can be dated back to the Warring States Period. In his masterpiece *Zhuangzi · Panzhong*, Zhuang Zhou said that "One-foot-long shovel, taken a half every day, will not disappear forever." Liu Hui, a mathematician during the Three Kingdoms period, mentioned "the one that is connected and cut with the inner positive" in the *Nine Chapters of Arithmetic Notes*. It is about the method to get the area of a circle by multiplying the sides of a regular polygon --- "A small cut will make it lose less. Continue cutting it until it can't be cut any more. Then it is the same with the side of the circle and there is nothing to be done." It is a wonderful and profound exposition of the ideas and methods of limits. Due to the limitation of historical conditions, there is no abstract concept of limits, no variables, no Cartesian analytic geometry, and no basis for studying motion, but this idea was discovered more than a thousand years earlier than European mathematicians. When introducing this concept, teachers will help students find out the wisdom of our ancestors, abandon the blind worship of foreign countries, strengthen their patriotic spirits, enhance national pride, and guide students to absorb the essence in the development of the society, and fully understand their own social responsibility and inherit the national culture [6].

3.2. Helping Students Establish a Correct Outlook on Life and Values

Many detailed knowledge points in advanced mathematics contain the elements of ideological and political education. Teachers should give full play to the function of ideological and political education and take advantage of the situation, guide and educate students to learn to do things properly, and establish a correct outlook on life and values [7]. For example, when explaining the concept of maximum value and maximum value, teachers should not only teach students to find the maximum value and maximum value of a function, but also let students understand the essence of a country, a unit, a department, and even a person's life lies on the pursuit of the maximum value. In order to achieve this maximum, they cannot indulge in playing games or other trivial things like this.

Actually, they must work hard and avoid becoming “the smallest value”. When they truly understand the concept of maximum value and minimum value, students will understand that people will encounter various good times and adversities (maximum value and minimum value) in their life, but as long as they face success and defeat properly, they will surely achieve success one after another in their life.

3.3. Learning from the Successful Mathematicians and Fighting for Success

The core part of advanced mathematics is calculus. Calculus is a well-developed course in modern college teaching system, which is the result of the joint efforts of many famous mathematicians. Famous mathematicians who are often mentioned in the textbooks are Newton, Leibniz, Euler, Cauchy, Lagrange, Green, etc. Teachers can use the experiences of these great mathematicians to encourage students to study hard and become determined to become the talents in the society. For example, when talking about Green’s formula, teachers can introduce the story of George Green to the students. Through Greene’s story, everyone is encouraged to learn from those diligent and courageous mathematicians and scientists, cherish the good time of studying, face difficulties, learn knowledge, and develop skills, and be useful to the society and the country in the future.

3.4. Relying on the Contest Platform to Create a Mathematical Cultural Atmosphere

3.4.1. Cultivating Students’ Excellent Qualities of Teamwork, Hard work and Perseverance

College Mathematical Contest, College Mathematical Contest in Modeling, and American College Mathematical Contest in Modeling are the major contests that college students participate in. These contests help educate innovative talents with strong mathematical foundation and mathematical culture, create a good mathematical cultural atmosphere and cultivate students’ profound mathematical cultural heritage. After years of theoretical research and practical exploration, a series of topics have been created with two general elective courses (including mathematical culture and broadening mathematics) and a series of curriculum ideological and political activities, such as Xuexitong and University Impression, in order to enhance mathematical cultural accomplishment and popularize mathematical culture and knowledge, etc.

The process of participating in the Mathematical Modeling Contest is full of difficulty. Students who can persevere under the premise that students are generally afraid of learning mathematics have gained a lot. The competition process has made the students deeply understand the importance of teamwork and students can have a better understanding of their ability. Through the contests, the potentials of the students will be discovered, and the excellent qualities of teamwork, hard work and perseverance were cultivated in the students.

3.4.2. Cultivating Students’ Meticulous and Scientific Attitude

The topics of mathematics contests do not always appear in students’ study. When solving problems, students not only need to have solid basic mathematics skills, but also have the ability to use mathematical methods flexibly to solve problems. Therefore, mathematics contests are challenging for students and participating in mathematics contests is also an exercise of students’ will. The process of solving problems in mathematics contests enables students to experience the difficult process of solving problems, and cultivates students’ will to study tenaciously. Mathematical concepts are rigorous and precise and mathematical proofs must be impeccable. In addition, mathematical solutions must be well-documented and mathematical conclusions must be precise. Therefore, mathematics cultivates and educates students with a meticulous, practical and

scientific attitude and a sense of integrity [8].

4. Conclusion

Curriculum ideological and political education is a relatively new concept. To achieve better results, the key lies in teachers. Mathematics teachers in colleges and universities take the initiative to update their teaching concepts, fully realize the role of curriculum ideological and political education in the integration of knowledge imparting, ability training and value shaping in mathematics teaching, and realize the importance of ideological and moral construction in students' learning. Students' ideological and moral level goes in line with their responsibility and mission. Based on the principle of "knowledge imparting and value guidance", without changing the original curriculum system and focus, teachers explore the ideological and political elements of the curriculum and carefully design the teaching contents. Then the ideological and political elements are subtly integrated into the theoretical knowledge of mathematics, and the educating function of the mathematics curriculum is fully exerted.

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References

- [1] Zheng, Y. (2018) *Building a System of "Three Comprehensive Education" Based on Moral Education*. *China University Teaching*, 11, 11-14.
- [2] Yang, X. (2018) "Three Comprehensive Education" in *Higher Education: Theoretical Implications, Problems and Solutions*. *China Higher Education*, 18, 4-8.
- [3] Gu, P. (2018) *Mathematical Culture (Second Edition)*. Beijing: Higher Education Press.
- [4] Qiu, C, Yang, L., and Ji, L. (2012) *Charming Mathematics: Mathematics and Humanities*. Beijing: Higher Education Press.
- [5] Gou, C. and Gu, P. (2008) *Improving Mathematics Teaching in Liberal Arts by Integrating Mathematical Culture*. *Journal of Mathematics Education*, 6, 5-7.
- [6] Lv, Y. (2019) *Exploring the Integration of Advanced Mathematics and Curriculum Ideological and Political Education from the Perspective of Mathematical Culture*. *Journal of Western*, 4, 97-100.
- [7] Liu, C. (2018) *Reflection on the Curriculum Ideological and Political Education in Colleges and Universities*. *Ideological and Theoretical Education*, 6, 62-67.
- [8] Song, Y. and Hua, Z. (2020) *Approaches and Methods for the Integration of Mathematical Culture into University Mathematics Courses*. *Think Tank Times*, 6, 103-107.