

MATHEMATICAL SCIENCES

RESEARCH ON INTEGRATING IDEOLOGICAL AND POLITICAL ELEMENTS INTO HIGHER ALGEBRA CLASSROOM TEACHING --- TAKING LINEAR TRANSFORMATION AS AN EXAMPLE

Zhang yu

*JiNing Normal University, School of Mathematics and statistic
Ulanqab, 012000, Inner Mongolia, P. R. China*

Research Project: 2022 Inner Mongolia Autonomous Region Education Science Research "14th Five-Year Plan" Project (NGJGH2022083)

Zhang yue

*JiNing Normal University, School of Mathematics and statistic
Ulanqab, 012000, Inner Mongolia, P. R. China
<https://doi.org/10.5281/zenodo.14236007>*

Abstract

After the national conference on ideological and political education in higher education, universities have gradually begun to develop curriculum integration of ideological elements, focusing on how to incorporate these elements into university mathematics teaching to construct a new educational model. This paper takes the teaching of linear transformations in higher algebra as an example, using case studies such as spacecraft attitude adjustment to explore the demand for ideological education in higher algebra, integration pathways, and implementation strategies. It aims to enhance students' mathematical abilities and sense of social responsibility while stimulating their scientific interest and innovative thinking.

Keywords: Ideological and Political elements; Curriculum-based ideological and political education; Linear transformations; Classroom teaching

1 Introduction

In May 2014, during a discussion with teachers and students at Peking University, Xi Jinping stated, "Knowledge is an important foundation for establishing core values." ^[1] This clearly indicates that knowledge serves as the basis for cultivating core values, and mastering professional knowledge helps students better understand society and the world, thereby establishing correct values and promoting personal and social development. In December 2016, General Secretary Xi emphasized at the National Conference on Ideological and Political Work in Universities that "we must consistently prioritize moral education as the central link and integrate ideological and political work throughout the entire education process, achieving comprehensive education and all-round development, and strive to create a new landscape for the development of higher education in our country." ^[2] Various universities actively implement the spirit of the conference by developing ideological and political education within their curricula, exploring and enriching educational resources in their courses to fulfill the mission of moral education. In May 2020, the Ministry of Education issued the "Guidelines for the Construction of Ideological and Political Education in Higher Education Curricula," stating, "Integrate ideological and political education throughout the talent cultivation system, and comprehensively advance the construction of ideological and political education in university curricula, maximizing the educational role of every course." ^[3] The guidelines require universities to incorporate ideological and political education into their talent cultivation systems to ensure the comprehensiveness and consistency of education.

Integrating ideological and political education with the teaching of advanced algebra not only enriches the educational content but also innovates teaching methods, making it a vital approach for cultivating well-rounded talent. By combining advanced algebra with cutting-edge practical applications, we can develop high-end professionals capable of solving real-world problems, which is of significant importance for technological advancement and economic development.

2 The Demand for Ideological and Political Education in Advanced Algebra Courses

The advanced algebra course not only establishes a foundation in mathematics but also cultivates logical thinking and problem-solving abilities. By integrating ideological and political elements, we can enhance students' mathematical skills while also strengthening their sense of social responsibility and moral character. Exploring the societal contributions of mathematicians and the impact of mathematical techniques on social development helps students understand the relationship between science, technology, and social progress, thereby igniting their sense of social responsibility and mission.

Moreover, modern education emphasizes the comprehensive development of morality, intelligence, physical fitness, aesthetics, and labor, with ideological and political education as a crucial component. This aspect not only relates to students' moral and ethical levels but also influences their values and outlook on life. By integrating ideological and political education into advanced algebra courses, and through discussions of practical problems, we can enhance students' awareness of social issues and improve their understanding of social responsibility and ethical standards. This teaching

approach not only enhances students' overall quality but also increases their sensitivity to social and cultural issues within the context of mathematics, achieving an organic integration of disciplinary knowledge and moral education, and cultivating high-quality talent with well-rounded development.

3 The Integration Path of Ideological and Political Education in Linear Transformations

Linear transformations are a core concept in advanced algebra, crucial for both theoretical understanding and practical applications. Integrating ideological and political education into the teaching of linear transformations not only helps students master mathematical knowledge but also enhances their sense of social responsibility and moral character. Here are several key paths for integrating ideological and political education into linear transformations:

First, incorporating historical context and social contributions into theoretical teaching aids students in deeply understanding mathematical concepts like linear transformations. Teachers can introduce mathematicians such as Hilbert and Cayley, highlighting their contributions to the development of linear transformation theory and how these theories respond to societal needs and scientific progress. Through historical narratives, students can appreciate the academic value of mathematics and its close relationship with social development, fostering a profound understanding of mathematics and its societal impact.

Second, organizing classroom discussions and moral education is essential. In linear transformation classes, teachers can design discussion topics that involve moral character and social responsibility, encouraging students to approach mathematical problems from these perspectives, thereby enhancing their moral awareness and sense of responsibility. Additionally, discussing different viewpoints and solutions cultivates students' critical thinking skills and teamwork spirit.

Finally, integrating ideological and political education in linear transformation teaching requires clear educational goals within the curriculum design, along with relevant teaching activities and assessment mechanisms. Such a design can enhance students' mathematical abilities while also fostering their social responsibility and moral character.

In summary, incorporating ideological and political education into linear transformation classroom teaching can not only improve students' mathematical literacy but also promote their overall development,

cultivating high-quality talent with a sense of social responsibility and moral character.

4 Case Study Based on Linear Transformations

Using "Matrices of Linear Transformations" as a case study to integrate ideological and political education into teaching helps students enhance their social responsibility and moral character while mastering professional knowledge.

First, when setting teaching objectives, two ideological and political goals can be added to the traditional objectives for teaching linear transformation matrices:

(1) Master the definition and properties of linear transformation matrices while incorporating stories of renowned mathematicians into the teaching. This aims to cultivate students' diligence, abstract thinking abilities, and problem-solving skills, inspiring perseverance and a spirit of exploration when faced with difficulties.

(2) Through social practice teaching, illustrate the applications of linear transformation matrices in real life to foster students' pursuit of truth, the application of scientific principles and methods, respect for facts and evidence, and the establishment of empirical awareness and a rigorous work attitude. [4]

Moreover, teachers can enhance students' interest in learning and help them intuitively understand abstract concepts by introducing linear transformation matrices through the stories of mathematicians.

In the 19th century, German mathematician David Hilbert stated, "Mathematics is a precise science, and its foundation is solid and stable." Learning about linear transformation matrices is about exploring this precision. The concept of linear transformation matrices was first introduced by 19th-century British mathematician Arthur Cayley. He discovered that matrices could represent linear transformations, laying a solid foundation for the development of mathematics. Another great German mathematician, Felix Klein, further expanded this concept by introducing the notion of "linear groups" and studying the relationships between linear transformations, providing important tools for understanding and manipulating linear transformation matrices.

Definition 1 Let V be a n -dimensional linear space over a field P , and let $\alpha_1, \alpha_2, \dots, \alpha_n$ be a basis of V . If σ is a linear transformation of V , then the image of this basis under the transformation σ is given by

$$\begin{cases} \sigma(\alpha_1) = a_{11}\alpha_1 + a_{12}\alpha_2 + \dots + a_{1n}\alpha_n, \\ \sigma(\alpha_2) = a_{21}\alpha_1 + a_{22}\alpha_2 + \dots + a_{2n}\alpha_n, \\ \vdots \\ \sigma(\alpha_n) = a_{n1}\alpha_1 + a_{n2}\alpha_2 + \dots + a_{nn}\alpha_n, \end{cases}$$

Record $\sigma(\alpha_1, \alpha_2, \dots, \alpha_n) = (\sigma(\alpha_1), \sigma(\alpha_2), \dots, \sigma(\alpha_n)) = (\alpha_1, \alpha_2, \dots, \alpha_n)A$

Among them $A = \begin{pmatrix} a_{11} & \dots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \dots & a_{nn} \end{pmatrix},$

Then, A referred to as the matrix a linear transformation σ under $\alpha_1, \alpha_2, \dots, \alpha_n$. Ошибка! Источник ссылки не найден.

At the same time, to help students better understand the definition of linear transformation matrices, teachers can incorporate the scientific story of Einstein's theory of relativity.

In the early 20th century, Albert Einstein proposed the theory of relativity, revolutionizing the understanding of time, space, and matter. He likened the universe to a curved stage, with celestial bodies and matter as actors, and gravity as the force that curves the stage. Einstein used linear transformations and matrices to describe this curvature phenomenon. On the cosmic stage, vectors represent each point, while matrices compute their changes. Linear transformation matrices reveal the mysteries of the universe and play a critical role in computer graphics, machine learning, and engineering design. By linking linear transformation matrices with Einstein's theory of relativity, we demonstrate the practical applications of mathematical concepts, inspiring students' scientific interest and curiosity, and helping them gain a deeper understanding of the connection between mathematics and the real world. Ошибка! Источник ссылки не найден.

Linear transformations and matrices are respectively geometric and algebraic concepts, and their relationship is evident in the way algebraic methods can be used to solve geometric problems, while geometric methods can also be applied to matrix problems. Mastering this approach is at the core of advanced algebra, allowing students to experience the rigor of mathematics and apply transformative thinking to solve real-world issues. Linear transformations and matrices are essential tools in scientific research and technological development, with significant applications for national progress, and through examples, students can appreciate their wide-ranging impact.

Example 1 Spacecraft Attitude Control

In the field of aerospace, spacecraft attitude control is crucial for ensuring proper operation and mission completion. By using multiple attitude thrusters, great scientists can change the orientation of the spacecraft. Now, suppose there is a spacecraft whose attitude can be adjusted by changing its angular momentum. Given the initial angular momentum vector of the spacecraft

$Ha = pa \times L$, and the torque matrix of the attitude

thrusters $A = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$, find the new an-

gular momentum vector of the spacecraft after a series of thruster firings (L).

By demonstrating the application of linear transformation matrices in national development, students not only deepen their understanding of matrices but also recognize the important role of mathematics in the progress of the nation. This encourages students to explore unknown fields, cultivate innovative thinking and a spirit of inquiry, master scientific principles, respect

facts and evidence, and develop empirical awareness and a rigorous attitude. Additionally, through examples of multiple scientists collaborating to control the spacecraft, students learn the importance of teamwork, enhancing their communication and collaboration skills.

5 Implementation Strategies and Recommendations

Integrating ideological and political elements into the teaching of linear transformations in advanced algebra requires clear implementation strategies and recommendations.

First, establish clear teaching objectives by incorporating ideological and political education goals into the course syllabus, ensuring that each lesson covers both mathematical theory and discussions on social responsibility and ethics. Second, design teaching content related to ideological and political education. For instance, when explaining linear transformation matrices, introduce the social backgrounds and contributions of relevant mathematicians, emphasizing the role of mathematics in social development. Select practical cases related to current social issues, such as spacecraft attitude control, to demonstrate the real-world applications of linear transformations and their societal impacts.

By citing the perspectives and achievements of these great mathematicians, students can gain a deeper understanding of the importance and value of linear transformation matrices. Additionally, through analyzing the work and thoughts of mathematicians, students can learn to think critically, evaluate different viewpoints, and develop their abstract thinking skills and abilities to analyze and solve complex problems. The stories of mathematicians can also cultivate students' perseverance and spirit of exploration when facing difficulties.

Furthermore, provide teacher training and instructional support, and conduct regular training sessions on ideological and political education to enhance teachers' abilities to integrate these elements into the curriculum. Establish an effective feedback mechanism to adjust teaching strategies in a timely manner based on student feedback and classroom assessments, ensuring the effective integration of ideological and political elements. Through these strategies, it is possible to enhance students' mathematical abilities while also improving their sense of social responsibility and overall quality.

6 Conclusion

Integrating ideological and political elements into advanced algebra classrooms, particularly using linear transformations as an example, holds significant educational value. Through case studies, this paper explores specific paths for effectively incorporating ideological and political education into advanced algebra and presents implementation strategies and recommendations. This integration not only helps enhance students' mathematical abilities but also strengthens their sense of social responsibility and overall quality. Future research and practice will further refine these methods, providing more references and support for ideological and political education in advanced algebra, and promoting the comprehensive realization of educational goals.

References:

1. Xi Jinping. Young People Should Consciously Practice the Core Socialist Values: Speech at the Discussion with Teachers and Students at Peking University[N]. Guangming Daily, 2014-05-05(02).
2. Xi Jinping. Integrate ideological and political work throughout the entire educational process.[N]. Guangming Daily, 2016-12-09(01).
3. Ministry of Education of the People's Republic of China. 《Notice on the Issuance of the 'Guidelines for the Construction of Ideological and Political Education in Higher Education Curricula》
.http://www.moe.gov.cn/srcsite/A08/s7056/202006/t20200603_462437.html.
4. Gao Ruimei, Lv Tanghong, Jiang Zhixia. Exploring and Integrating Ideological and Political Elements in the Teaching of Advanced Algebra Courses.[J]. Academy,2023,16(25):7-9.
5. Wang Efang, Shi Shengming. "Advanced Algebra (5th Edition).[M]. Beijing: Higher Education Press,2019.
6. Liu He, Shi Ying, Jin Xianglei. Rational Connotations and Implementation Paths of Curriculum Ideological and Political Education [J]. Teaching in Chinese Universities, 2019(3):59-62.