

Original Paper

Research on the Practice of Ideological and Political Education in Mathematics Courses in Vocational Universities Based on Classroom-Training-Competition Mode

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Abstract

The purpose of this study is to explore how to effectively integrate ideological and political education into the mathematics curriculum by proposing a "combination of classroom teaching, practical training projects, and competition activities". By organically combining classroom teaching, practical training projects, and competition activities, it promotes students' learning of mathematical knowledge while enhancing their sense of social responsibility and professional ethics. Research results show that this model has significantly improved students' mathematics performance, especially in terms of basic knowledge and modelling ability. At the same time, by participating in mathematical modelling competitions and practical training, students have demonstrated strong teamwork spirit and innovation ability, and their professional ethics have been significantly improved. Through questionnaires and interviews, the feedback results show that students attach great importance to the practical value of the curriculum and ideological and political education. Finally, the research suggests that the integration of ideological and political elements into more mathematics courses should be explored in the future, in order to improve the quality of education and cultivate high-quality talents with a sense of social responsibility and professional ethics.

Keywords

Vocational universities, Classroom-training-competition mode, Mathematics courses, Ideological and political education, Integration practice

1. Introduction

Since the "Several Opinions on Deepening the Reform and Innovation of Ideological and Political Theory Courses in Schools in the New Era" was issued by the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council in 2019, ideological and political courses have become an important task of educational reform at all levels and types of schools. The policy emphasizes the integration of ideological and political education into all courses and teaching processes, so as to achieve an organic unity of knowledge transmission and value guidance (Zhang et al. 2020). Especially in vocational undergraduate education, the cultivation of students' professional ethics and sense of social responsibility is particularly important. Mathematics, as a fundamental subject in vocational undergraduate education, not only bears the responsibility of transmitting professional knowledge, but also should guide students to form a correct professional, value and world view through course content (Jiang et al. 2023).

The cultivation of practical skills and professional ethics is crucial in undergraduate vocational education. As an instrumental subject, mathematics courses provide the necessary theoretical foundation for students' future professional learning and career development (Wang, 2024). Therefore, the effective integration of ideological and political education into mathematics curriculum can not only improve students' subject knowledge, but also further promote the comprehensive development of professional ethics, thereby enhancing students' sense of social responsibility (Sun et al., 2023). In this context, the teaching model that combines "classroom-training-competition" provides an opportunity to effectively integrate theory and practice. Through course teaching, students can master theoretical knowledge, cultivate practical ability through practical training, stimulate innovative thinking through competitions, and integrate ideological and political elements to enhance students' comprehensive quality and practical ability (Jiao, 2024). Therefore, the effective integration of ideological and political education in the "classroom-training-competition" mode not only strengthens students' understanding and application of mathematical knowledge, but also shapes their professional ethics and social responsibility, thereby improving their professional adaptability and social responsibility.

The core purpose of this study is to explore how to effectively embed ideological and political education through the "classroom-training-competition" mode and comprehensively improve the overall quality of vocational undergraduate students. By combining ideological and political education with mathematical knowledge, students can enhance their professional ethics, teamwork, innovation ability, and sense of social responsibility based on a solid grasp of mathematical theory. This exploration is not only of great significance for the personal development of students, but also provides theoretical support for the optimization of the entire vocational undergraduate education system.

Through the teaching mode of "classroom-training-competition", students' knowledge, skills and comprehensive qualities have been comprehensively improved. The combination of theoretical learning and practical application not only enhances the effectiveness of mathematics teaching, but also improves the penetration effect of ideological and political education. Students can cultivate a sense of

social responsibility and professional ethics in real life situations, laying a solid foundation for their career development.

In summary, this study aims to provide a feasible ideological and political teaching plan for vocational undergraduate mathematics courses, in order to promote the high-quality development of vocational education and cultivate high-quality technical and professional talents with comprehensive development of morality, intelligence, physical fitness, aesthetics and work ability. Through this study, we hope to provide new ideas and directions for the reform and innovation of vocational education.

2. Analysis of the Current Situation of Ideological and Political Education in Mathematics Courses in Vocational Universities

In vocational undergraduate education, mathematics courses, as a fundamental discipline, have the task of cultivating students' scientific thinking, logical reasoning ability and problem-solving ability, and also bear the important responsibility of ideological and political education. However, how to effectively integrate ideological and political education into mathematics courses and achieve the organic unity of knowledge teaching and value guidance has become an important issue in the current educational reform. This study analyzes the current situation of ideological and political education in vocational undergraduate mathematics courses from the aspects of ideological and political education penetration, teaching mode innovation, teacher quality improvement, and student participation.

2.1 Insufficient Penetration of Ideological and Political Education

Although the "Guidelines for the Construction of Ideological and Political Education in Higher Education Curricula" clearly states the need to integrate ideological and political education into various courses, the penetration of ideological and political education in vocational undergraduate mathematics courses is still insufficient in the actual teaching process. Mathematics courses usually focus on theoretical knowledge and problem-solving skills, while the content of ideological and political education often appears superficial and lacks systematicity and depth. Existing mathematics textbooks and teaching materials have relatively few ideological and political elements, which cannot provide teachers with sufficient reference and support, and the integration of ideological and political education is insufficient.

2.2 Insufficient Innovation in Teaching Mode

The slow progress of ideological and political education in vocational undergraduate mathematics courses has hindered the improvement of teaching effectiveness in terms of mode innovation. At present, the teaching mode is still mainly based on the traditional lecture style, which lacks sufficient interactivity and participation, and students are mostly in a passive receiving state in the classroom. Although a teaching model combining "classroom-training-competition" has been proposed, in practice, the practical aspects of ideological and political education have not been fully evaluated, and the integration of course content with students' career development needs is not high, making it difficult to achieve effective integration of theory and practice.

2.3 Improvement of Teachers' Quality

Teachers are the main implementers of ideological and political education in the curriculum, and their quality directly affects the effectiveness of teaching. However, teachers in professional mathematics courses still need to improve their skills in ideological and political education. Some teachers focus their teaching on imparting professional knowledge, neglecting the value-guiding function of ideological and political education, and failing to organically integrate ideological and political goals into mathematics teaching. In addition, teachers have limited training opportunities in the concepts, methods and skills of ideological and political education, and lack systematic learning, which makes it difficult for them to play their proper role in educating students in teaching practice.

2.4 Low Student Participation

The effectiveness of ideological and political education not only depends on the teaching design of teachers, but also requires the active participation of students. However, the participation rate of students in the current vocational undergraduate mathematics courses is generally low. The correlation between the content of ideological and political education and students' actual life and career development is not close enough, and many students lack interest and intrinsic motivation in learning, resulting in low class participation. The lack of effective interaction and feedback mechanisms in the classroom makes it difficult for students to receive timely responses to their opinions and suggestions, limits the opportunities for improving teaching, and further reduces students' enthusiasm to participate.

3. Integration of Classroom Competition into the Ideological and Political Practice of Mathematics Teaching at Vocational Universities

3.1 Setting of Course Ideological and Political Objectives

The core of ideological and political education in courses lies in the organic integration with subject knowledge, subtly achieving ideological and political education, rather than treating it as an independent ideological and political course. In vocational undergraduate mathematics courses, teachers can effectively integrate ideological and political elements into teaching by introducing practical problems. For example, when teaching probability theory and statistics, combining the phenomenon of "data fraud" in professional ethics, guiding students to recognize the importance of integrity in data analysis and application. This combination not only enhances students' interest in course content, but also helps them deeply understand the value of integrity in future careers.

In addition, the emphasis on logical reasoning, rigorous thinking, and professional ethics in mathematics courses is closely linked, which helps students improve their ability to solve complex problems. Through the integration of ideological and political education, students' sense of social responsibility and professional mission can also be enhanced, making them more confident in facing professional challenges.

3.2 Curriculum Teaching Design

In vocational undergraduate mathematics courses, curriculum design that incorporates ideological and

political elements is crucial. For example, when teaching the concept of matrices in linear algebra, teachers can analogize matrices to models of teamwork, where each element represents a member of the team, and only when all members do their best can the team (matrix) operate efficiently. This analogy not only helps students understand abstract mathematical concepts, but also enables them to appreciate the importance of teamwork, laying the foundation for future collaboration in the workplace. In calculus courses, teachers can combine the rate of change and limits of functions to emphasize the gradual nature of career development and encourage students to achieve career progress through continuous learning and effort. This approach of combining mathematical knowledge with career development can effectively stimulate students' enthusiasm for learning and help them realize the practical benefits of mathematics for career growth.

3.3 Training Teaching Design

Practical training is an important link that combines theory with practice. By setting tasks with practical professional backgrounds, ideological and political education can be integrated into the process of task completion. For example, in data analysis training, teachers can require students to follow data privacy protection laws when processing enterprise data, strengthening their professional ethics awareness. This not only enhances students' practical skills, but also strengthens their professional ethics, forming habits of complying with laws and ethical norms.

By introducing real-life professional scenarios into mathematics teaching, students can not only master mathematical knowledge but also cultivate analytical and problem-solving thinking patterns when completing practical tasks, thereby improving their vocational adaptability. For example, simulating project management scenarios, students not only learn specific mathematical tools when building mathematical models, but also develop decision-making and teamwork skills, preparing them better for their careers.

3.4 Competition Teaching Design

Mathematical modelling competitions provide students with valuable opportunities to solve practical problems within a limited amount of time. In such a competitive environment, not only does it test students' mathematical abilities, but it also exercises their teamwork and stress resistance. Teachers can incorporate ideological and political elements such as social responsibility and ethics when designing competition topics, encouraging students to think about social responsibility in the process of problem-solving. For example, students are required to balance environmental protection and sustainable development while considering solutions to business problems, in order to cultivate their sense of social responsibility.

Teamwork in competitions also makes students aware of the importance of individual responsibility. Through division of labour, collaboration, and joint task completion, students not only enhance their creativity, but also deepen their understanding of team responsibility and social responsibility by solving practical problems. The sense of responsibility and team spirit cultivated during this competition will lay a solid foundation for students' future career development.

4. Practical Case Analysis

4.1 Case Analysis of Ideological and Political Education in Mathematics Courses

In a mathematical modeling course, the teacher used "environmental protection" as the teaching theme and guided students to establish mathematical models to analyze the balance between pollution emissions and enterprise production. In this process, students not only master the basic skills and methods of mathematical modeling, but also deeply understand the importance of environmental protection in modern society by analyzing model results. This teaching design makes students realize that mathematics is not only a tool, but also an effective means of solving social problems.

In order to evaluate the effectiveness of this teaching case, the teacher collected feedback from students through a survey questionnaire and interviews. The results showed that students generally believed that this course had given them a deeper understanding of environmental protection and enhanced their personal sense of social responsibility. Meanwhile, many students have expressed that their professional ethics have significantly improved through discussions and collaborations with their classmates. The positive feedback from students not only provides a reference for optimizing subsequent courses, but also further proves the necessity and effectiveness of integrating ideological and political elements into mathematics courses.

4.2 Presentation of the Integrated Teaching Results of the Course Training and the Competition

The integrated teaching mode of classroom-training-competition effectively promotes students' two-way improvement in theory and practice. Taking the mathematical modelling competition as an example, students' performance reflects the implementation of ideological and political goals. In a competition, a student team successfully designed a mathematical model for optimizing urban transportation. During the construction process, team members actively discussed and collaborated, ultimately proposing practical and feasible traffic improvement plans. In this process, students not only applied mathematical knowledge, but also deepened their understanding of social responsibility through teamwork, demonstrating a strong sense of responsibility and cooperation.

At the same time, practical training also provides a basis for evaluating students' professional competence and achieving ideological and political goals. In the practical training task, students are required to follow professional ethical standards when solving problems, such as ensuring data privacy and using real data. Through the evaluation of practical training results, teachers found that most students demonstrated high professional ethics in the tasks, and were able to consciously maintain academic integrity and fulfil social responsibilities. These achievements not only reflect the success of integrating teaching with training and competition, but also lay a solid foundation for students' future career development.

5. Teaching Effectiveness Evaluation and Feedback

5.1 Design of Evaluation Indicator System

A comprehensive evaluation index system has been designed to comprehensively assess students'

learning effectiveness and achievement of ideological and political goals in mathematics courses, including two main dimensions: mastery of mathematical knowledge and achievement of ideological and political goals. In terms of mastering mathematical knowledge, basic knowledge tests and modelling ability assessments are used to understand students' mastery of basic concepts, theorems, and applications; In terms of ideological and political goals, students' performance in these areas is evaluated through professional ethics assessments and social responsibility surveys. The specific evaluation indicators and methods are shown in Table 1.

Table 1. Evaluation Indicators and Methods

Evaluation Dimension	Evaluation Indicator	Evaluation Method
Mastery of Mathematical Knowledge	Basic Knowledge Test	Regular tests and exams are given to assess students' mastery of basic mathematical concepts, theorems, and applications
	Assessment of Modeling Skills	Participation in mathematical modeling competitions to evaluate the rationality of models, effectiveness and innovation of solutions
Achievement of Ideological and Political Goals	Professional Ethics Assessment	Students' understanding and application of professional ethics will be assessed through case analysis, classroom discussion, and role-playing
	Social Responsibility Survey	Using a questionnaire survey to assess students' sense of social responsibility, including cognition, attitude, and practical situation

5.2 Analysis of the Effectiveness of Student Learning and Feedback

In the combination of classroom-training-competition mode, students' learning effectiveness and feedback are important criteria to measure the teaching effectiveness. By comparing students' grades in different semesters, we can understand the improvement of students' mathematical knowledge mastery under this model. The comparison of mathematics course grades in different semesters is shown in Table 2.

Table 2. Comparison of Grades of Courses in Different Semesters

Semester	Average Score before the Course	Average Score after the Course	Increase the Amplitude
First Semester	75	82	+7
Second Semester	78	85	+7
Third Semester	76	84	+8

From the above data, it can be seen that the combination of classroom-training-competition can help improve students' mathematics performance, which has improved significantly in different semesters. In addition, by collecting students' performance in practical training, we can evaluate their professional ability and the achievement of ideological and political goals. The results are shown in Table 3.

Table 3. Student Feedback Information

Feedback Project	Feedback Ratio
Improvement of Ethical Awareness	80%
Improvement of Teamwork Skills	75%
Improvement of Problem-solving Skills	70%

Teachers also conducted a questionnaire survey to further collect students' feedback on the course content, teaching methods, and ideological and political education. The results of students' satisfaction feedback data on the course are presented in Table 4.

Table 4. Presentation of Questionnaire Results

Content of the Feedback	Level of Satisfaction
The Practical Value of the Course Content	85%
The Importance Teachers Attach to Ideological and Political Education	90%
Innovation of Teaching Methods	78%

These data show that students are generally satisfied with the practical value of the curriculum, the emphasis on ideological and political education, and the innovation of teaching methods, indicating that the combination of classroom-training-competition has achieved good results in students' learning achievements and ideological and political education.

5.3 Teacher Reflection and Improvement in Teaching

Teachers should always maintain the habit of teaching reflection in the teaching process, discover the shortcomings in curriculum design and implementation through reflection, and propose corresponding improvement measures. In terms of curriculum design, teachers should regularly evaluate whether the embedding of ideological and political elements in mathematics courses is natural and reasonable, ensure that students think deeply about professional ethics and social responsibility issues while learning mathematics, and deepen their understanding in classroom discussions and practical activities. At the same time, teachers should also analyse the connection between the content of mathematics curriculum and practical applications, and ensure that the knowledge taught can stimulate students' interest and be closely integrated with future career development.

In terms of teaching implementation, teachers should pay attention to challenges such as classroom

management, time management, and student participation. By observing classroom performance, teachers can identify students' difficulties in the learning process, such as insufficient understanding of certain mathematical concepts, and adopt more targeted teaching methods to help students overcome difficulties and improve learning outcomes.

Based on these reflections, teachers can propose multiple improvement suggestions, such as optimizing course content, adjusting teaching methods, or adding practical elements, to enhance teaching effectiveness and ideological and political education effectiveness under the classroom-training-competition mode. Through continuous teaching reflection and improvement, teachers can not only improve students' learning experience and academic performance, but also help students establish good professional ethics and social responsibility, and ultimately achieve the teaching goal of cultivating high-quality talents with comprehensive development.

6. Conclusions and Outlook

6.1 Main Conclusions of the Study

This study explores the organic integration of mathematics curriculum and ideological and political education through a combination of classroom-training-competition, and draws the following main conclusions:

Firstly, the combination of classroom-training-competition has a significant promoting effect on ideological and political education in the curriculum. By integrating classroom teaching, practical training projects, and competition activities, students not only learn mathematical knowledge but also deeply understand the importance of social responsibility and professional ethics. This model not only enhances students' practical application ability of mathematical knowledge, but also effectively promotes their teamwork awareness and innovative spirit. In addition, the practical problem-solving in competitions and the consideration of professional ethics in practical training have made ideological and political education run through the entire learning process, and students' professional ethics and social responsibility have been significantly improved.

Secondly, in terms of effectively cultivating professional ethics and social responsibility in mathematics courses, the combination of classroom-training-competition has demonstrated its unique value. Mathematics courses are not only limited to imparting theoretical knowledge, but also a platform for cultivating students' logical thinking ability, problem-solving ability, and sense of social responsibility. By integrating ideological and political elements such as environmental protection and social justice into the teaching process, students not only master the skills of mathematical modelling and data analysis, but also learn how to adhere to professional ethics and fulfil social responsibilities in practical work. This indicates that ideological and political education plays an important role in cultivating vocational undergraduate mathematics courses and has a profound impact on students' future career development.

6.2 Future Research and Practice Directions

There is still much room for exploration and improvement in future research and teaching practices. Firstly, the deep integration of ideological and political elements into more mathematics courses will be an important development direction. Current research mainly focuses on specific mathematics courses, and there may be differences in the needs and implementation methods of ideological and political education among different types of mathematics courses. Therefore, in the future, it is necessary to further explore how to creatively integrate ideological and political elements in more courses, such as advanced mathematics, probability theory, and linear algebra, and find more diverse teaching paths.

Secondly, future research should also focus on enhancing the innovation and relevance of mathematical ideological and political education. In order to meet the needs of different majors and student groups, future ideological and political education can be more flexible and personalized to help students understand the importance of social responsibility and professional ethics in different contexts. For example, in applied mathematics courses, more case studies related to real-world problems can be added, so that students can feel the deep meaning of ideological and political education in the process of solving practical problems. At the same time, the future teaching design should also strengthen the connection with social needs, enhance the effectiveness of mathematical ideological and political education, and enable it to play a greater role in students' career development.

Through continuous exploration and innovation, the combination of classroom-training-competition is expected to be widely applied in more mathematics courses, which will further improve the quality and effectiveness of ideological and political education, and help cultivate high-quality talents with social responsibility and professional ethics.

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