

On the Teaching Mode of Linear Algebra under the Background of "New Engineering Education + Ideology and Politics Education"

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Abstract: *This paper analyzes the pain points of teaching research under the background of "new engineering education + ideological and political education", points out the necessity of combining the both, and gives the corresponding solutions. In addition, the teaching case shows the method of combining new engineering education and ideological and political education. Through empirical research, it is found that this method is feasible and can better achieve the purpose of teaching and educating people.*

Keywords: *New engineering, curriculum ideology and politics, linear algebra, case study*

1. Introduction

In 2017, in response to a new round of scientific and technological revolution and industrial reform, the ministry of education of China made great efforts to promote the construction of "New Engineering Education" [1]. In 2020, the ministry of education of China issued the guiding outline for the ideological and political construction of courses in colleges and universities, pointing out that colleges and universities should deepen education and teaching reform, fully tap the ideological and political resources of various courses, give full play to the educational role of each course, and comprehensively improve the quality of talent training [2]. The construction of new engineering education is a major strategy and deployment of higher engineering education reform under the background of new scientific and technological revolution, new industrial revolution and new economy [3]. The integration and penetration of "New Engineering Education (NEE)" and "Ideological and Political Education (IPE)" is the inevitable trend of the development of education in the new era, which not only provides a development opportunity for higher education in the new era, but also inspires and promotes college teachers' thinking and exploration of the development of higher education in the future.

2. Current situation analysis

In this part, we will analyze the current situation of the research on the integration of ideological and political education into the teaching of new engineering and curriculum.

2.1. The necessity of combining NEE with IPE

With the further improvement of global information, the atmosphere and social environment of contemporary college students' Ideological and political education gradually presents diversity and complexity, and ideological and political education gradually presents conflict characteristics. Contemporary college students pursue individuality and freedom, have strong rebellious psychology, lack collective consciousness, and have strong utilitarianism in learning. They do not want to be bound, nor blindly advocate authority. They are more resistant to the traditional single classroom teaching mode, and like to acquire knowledge through personal practice.

In this background, the design of new engineering teaching cases, especially those close to students' study and life and closely related to their majors, can enhance students' sense of learning and exercise their ability to correctly understand, analyze and solve problems. On this basis, the rational and natural integration of ideological and political education into teaching practice can achieve the goal of strengthening students' ideological and political education, moral training and personality improvement

in a silent way, and truly achieve the purpose of teaching and educating people.

2.2. Problem analysis

At present, there are the following problems in the practice of "NEE + IPE":

(1) The application case study of new engineering is relatively sufficient, but it ignores the mining of ideological and political elements contained in the case itself. The main reason is that science teachers have solid professional and technical ability, but the level of cultural and historical foundation and humanistic quality is uneven. Although they have ideological and political awareness, their ability is insufficient, and they cannot achieve the ideal effect of Ideological and political education.

(2) The excavation of ideological and political elements is not deep enough, and the integration is unnatural. There is a widespread phenomenon that curriculum and ideological and political are separated.

2.3. Solutions

In order to solve the above problems, we can start from the following two aspects:

(1) Expand the teacher team, and attract ideological and political teachers to participate in the construction of linear algebra courses. This can not only give play to the profound advantages of Ideological and political teachers' theory and jointly discuss the laws of Ideological and political construction in the curriculum, but also explore more ideological and political methods and improve the educational consciousness and quality of professional basic course teachers.

(2) In order to better integrate ideological and political education into the teaching process, ideological and political elements can be added to the application cases of new engineering. First of all, simplify the problems closely related to the national economy and the people's livelihood and apply them to classroom teaching, which can enable students to understand the important role of linear algebra in the national economy and the people's livelihood, cultivate students' sense of responsibility and mission to explore the unknown, pursue the truth and climb the peak of science, and stimulate students' feelings of serving the country through science and technology and their mission. Then, students are required to analyze and solve the expansion cases in groups, which can cultivate students' ability to analyze and solve problems and abstract thinking ability, strengthen students' attitude of not afraid of difficulties and being rigorous and realistic, and cultivate students' academic norms and team spirit.

3. Teaching design of "NEE + IPE"

In this part, we will introduce in detail the teaching design idea and design method of "NEE + IPE".

3.1. Illustration of instructional design

The teaching design will be divided into three parts: basic knowledge, professional application and expansion. First of all, the basic knowledge part requires students to independently read the background knowledge related to the teaching content, such as the development history of this part and the anecdotes of relevant mathematicians, so as to stimulate students' sense of responsibility and mission for the country. Some simple knowledge will be completed by students themselves before class, explained by students in class and asked by teachers. Through this flipped classroom mode, on the one hand, students' autonomous learning ability is cultivated, and on the other hand, students' understanding of knowledge is deepened. In addition, new engineering application cases related to the specialty are added to the classroom teaching, and students' mathematical modeling ability and mathematical application awareness are cultivated through the process of "building models - solving problems - mastering knowledge". By solving practical problems related to the national economy and the people's livelihood, further strengthen students' sense of responsibility and mission for the country. Finally, expand and improve through after-school expansion homework and group activities. Through the expansion of classroom cases, students' knowledge transfer ability is enhanced, their scientific inquiry spirit is cultivated, and their academic norms are preliminarily cultivated. Cultivate their team cooperation ability through group discussion and promote the development of professional quality. Our specific instructional design idea is shown in Figure 1.

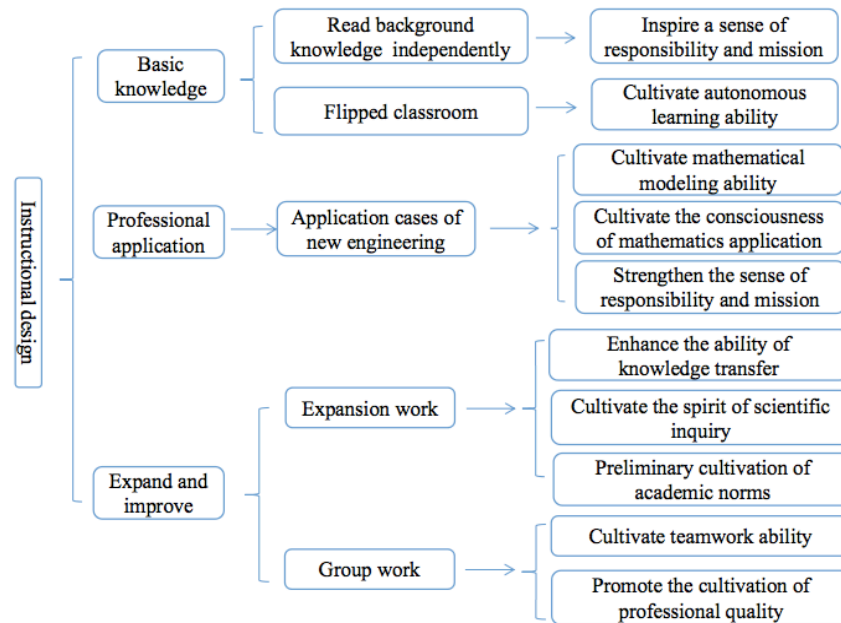


Figure 1: Instructional design idea

3.2. Examples of Instructional Design -- Taking the largest independent group of vector group as an example

Next, take the largest irrelevant group of vector group as an example to show the teaching design concept of "NEE + IPE".

3.2.1. Preparation before class

First of all, put the birth of the first color film in New China [4] in the resources of the teaching platform for students to read in advance, so that they can understand the development history of China's film industry and stimulate their sense of responsibility and mission for national development and national progress.

Secondly, the basic knowledge such as the definition and solution of the maximum independent vector group is recorded into a small video, supplemented by preview homework, for students to learn by themselves before class and cultivate students' autonomous learning ability.

3.2.2. Classroom teaching

Maximum independent vector group is an abstract concept in linear algebra. But if we change a simple and vivid language to describe it, students will understand it more thoroughly. To this end, we can design problem situations as follows to promote classroom teaching:

(1) How do the colorful colors appear in color films? We often use computers. We only need to fill in a set of RGB values on the color palette of the computer to uniquely determine a color. Why? This leads to the principle of three primary colors.

(2) If each color is regarded as a vector, how can the principle of three primary colors be described in mathematical language? From this, the definition of the largest irrelevant group is abstracted to exercise students' abstract thinking ability.

(3) Is the largest unrelated group unique? Answer this question through group discussion and cultivate students' thoughtfulness.

(4) What is the significance of the largest unrelated group? With the largest irrelevant group, color films become possible; With the largest independent group, we can establish a coordinate system to closely connect algebra and geometry. This shows the practical significance of the largest independent group.

3.2.3. Development after class

After class, take the group as the unit, find the data, extract the matrix corresponding to the given

color picture, and explain the principle. This problem can help students understand the meaning of the maximum independent vector group, and lay a foundation for the subsequent solution to the problem of color image compression [5]. Through this process, students can enhance their ability to transfer the knowledge they have learned, and cultivate their scientific inquiry spirit and academic norms. Through group discussion and group cooperation, cultivate students' teamwork ability and promote the cultivation of professional quality.

4. Effect feedback

In the fall semester of 2021, the proposed "NEE + IPE" method, which contains more than ten cases, was used for 77 students in the class. In order to evaluate the effects of the proposed method, a questionnaire survey was conducted on the students in class after the course. Three candidate answers were set for each question: A (stronger), B (unchanged), C (uncertain). The questionnaire survey included some questions related to the construction of "NEE + IPE". The percentages of students who chose A were calculated as shown in Table 1.

Table 1: Questionnaire survey of the effects

Ability and Consciousness	Stronger
Autonomous learning ability	98%
Mathematical modeling ability	95%
Mathematical application consciousness	94%
Knowledge transfer ability	94%
Sense of responsibility and mission	93%
Scientific inquiry spirit	96%
Teamwork ability	95%
Academic norms	93%
Professional quality	90%

It can be seen from Table 1 that the "NEE + IPE" method significantly met the teaching expectations.

5. Conclusion

"NEE + IPE" method covers application cases that reflect the practical problems of the professional background of new engineering, which enables students' professional learning in mathematics teaching and enhances the learning effect of new engineering students on mathematics courses. Following the teaching concept of curriculum ideology and politics and the principle of education, integrating curriculum ideology and politics, and realizing the guidance of mathematics curriculum on students' thoughts and outlook on life, is of great significance to improve the quality of education and teaching.

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