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Research on Teaching Practice of "Ideological and Political Course" in Major College Physics—Taking Electric Field Strength as an Example

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ABSTRACT
The fundamental task of education is to "cultivating people by virtue". This article takes the electric field intensity as an example, fully excavates the ideological and political elements contained in the teaching content, and conducts exploration and practice in classroom teaching to give full play to its main role in educating people. The combination of teaching and ideological and political education of college students can play the main channel function of classroom education, so as to achieve the unity of knowledge education and quality education, which provides a reference for the implementation of curriculum ideology in other chapters of teaching.
Keywords: *Curriculum ideology; field strength; teaching practice; college physics*

1. INTRODUCTION

In December 2016, General Secretary Xi Jinping emphasized in the National Ideological and Political Work Conference on the theme of "Lide to foster people and provide talent support for national rejuvenation", The whole process of education and teaching is to realize the whole process of educating people and all-round education." General Secretary Xi Jinping's important speech at the National Conference on Ideological and Political Work in Colleges and Universities, from the overall and strategic perspective of achieving the great rejuvenation of the Chinese nation, scientifically answered what colleges and universities cultivate The fundamental issue of such people, how to train them, and for whom, has pointed out the direction of action for the ideological and political work of colleges and universities and the development of higher education under the new situation. It was pointed out in the conference that all other courses should keep a good section of the channel and plant a good field of responsibility, so that various courses and ideological and political theory courses can go in the same direction, forming a synergistic effect [1].

In 2017, the Party Group of the Ministry of Education of the Communist Party of China issued the "Ideological and Political Work Quality Improvement Project Implementation Outline" in the notice proposed a quality improvement system for curriculum education, vigorously promoted classroom teaching reform with the goal of "curriculum ideological and political", and optimized curriculum settings, Revise professional textbooks, improve teaching design, strengthen teaching management, sort out the ideological and political education elements contained in each professional course and the ideological and political education functions carried, integrate them into all links of classroom teaching, and realize the organic ideological and political education and knowledge system education Unity [2].

In March 2019, General Secretary Xi also proposed at the school's ideological and political theory course teacher forum: to tap the ideological and political education resources contained in other courses and teaching methods and to achieve all-round education for all employees [3]. In these large backgrounds, in order to implement this requirement, all courses are actively exploring curriculum ideology and politics, digging into ideological and political resources, combining the teaching goals of the course with the goals of moral education, and integrating curriculum ideology and politics into classroom teaching. Realize value guidance in the teaching of knowledge, actively promote the ideological and political construction of courses, and integrate knowledge, ability and quality.

College Physics is a discipline that studies the basic structure, interaction, and the most basic and universal modes of movement and mutual transformation of matter. It is closely related to philosophy and history. Theories involve various fields of natural science and are applied to various production technologies. Department is the foundation of natural science and engineering technology. In recent years, various domestic universities [4-9] have also actively tried ideological and political work in college physics teaching. For example, the School of Physics and Technology of Tianjin Polytechnic University proposed to use engineering certification as an opportunity to strengthen the ideological and political teaching research of college physics courses. Inner Mongolia University for Nationalities actively explores the ideological and political education resources of university physics courses. The School of Science of Shanghai University, Nanyang Normal University, and the Faculty of Sciences of Zhejiang Agriculture and Forestry University have also

conducted classroom practice explorations on the ideological and political courses of university physics. The content of college physics mainly includes mechanics, heat, optics, electromagnetism and modern physics. The content contains rich ideological and political elements. As a compulsory general education course for engineering majors in applied undergraduate colleges, it is used to cultivate talents in colleges. The plan has a very important position. Taking our school as an example, there are 16 undergraduate majors in college physics courses, and the average number of undergraduates involved in each academic year exceeds 1,000. Therefore, it is very necessary to implement curriculum ideology in college physics courses. College students play a broad role in ideological and political quality.

2. "CURRICULUM IDEOLOGICAL AND POLITICAL" TEACHING PRACTICE-TAKE ELECTRIC FIELD STRENGTH AS AN EXAMPLE

2.1. Course Introduction

According to life experience, when we push the table, through the direct contact between the hand and the table, the force is directly applied to the table. The force exists between the objects in contact with each other, but through the study in the last class, we know the magnitude and direction of the interaction force between two static point charges in a vacuum obeys Coulomb's law. The two point charges do not touch each other, but occur between two objects separated by a certain distance. There is no medium composed of atoms or molecules between two point charges. So how is the force between these two point charges transferred?

2.2. Course Design

2.2.1. Electrostatic field

Historically, there has been a long-term debate about the interaction between two point charges. One view is that this force can be acted on by an object immediately on another object sepatated by a certain distance without any medium or time, this view is called super-distance action; another view is that this type of force acts in close proximity, and the two are transmitted through an elastic medium that fills the space-"ether". The development of modern physics proves that the view of "super-distance action" is wrong. Although the propagation speed of electricity is very fast, it does not take time; and those who hold the view of "proximity action" in history assume that this kind of "flexible ether" does not exist either [10].

In fact, the interaction between electric charges is realized by the electric field generated by electric charge [11]. There is a special substance around any electric charge. This substance is invisible and intangible, but it is an objective existence. It is an electric field, which belongs to a material field and has objective properties such as force and energy of ordinary materials[12]. The electric field has the property of force, which is expressed as: the electric field has an effect on the charge placed in it, this force is called electric field force; the electric field also has the property of energy, which is expressed as: when the charge moves in the electric field, the electric field force acts on the charge. Doing work shows that the electric field has energy.

2.2.2. Electric field strength

2.2.2.1. Definition

First introduce the concept of test charge and field source charge.
Test charge: It must meet the requirements of point charge and sufficiently small charge.
Field source charge: The charge that can generates an electric field, also known as source charge.
The concept of electric field strength is introduced through experiments. Put two test charges $q, q' = 2q$ at a certain point in the electric field of the field source charge, then the magnitude and direction of the force on the two test charges at this point are different, indicating that the force on the test charge cannot be used to describe the electric field. The reason is that the force in the electric field is not only related to the field source charge and the position of the point in the field, but also related to the amount of test charge; if the test charge is placed at a different position, the electric field experienced by the test charge The magnitude and direction of the force are different, but the ratio of the electric field force to the charge quantity of the test charge is a constant vector, and we call this vector the electric field strength.
Definition of electric field strength: The electric field strength at a certain point in the electric field is equal to the electric field force experienced by the unit test charge at that point, $\vec{E} = \vec{F}/q_0$.
The physical meaning of electric field strength: describes the strength and direction of the electric field, and is a physical quantity that reveals the nature of the electric field force.
Unit: $\mathrm{N \cdot C^{-1}}$ or $\mathrm{V \cdot m^{-1}}$.
The nature of the electric field strength: It is vectorial. Generally, the test charge is taken as a positive charge, so the direction of the electric field strength at a certain point in the electric field is the same as the direction of the electric field force received by the positive test charge at that point. According to this regulation, the direction of the electric field force received by the negative charge at a

certain point in the electric field is opposite to the direction of the electric field strength at that point. The magnitude and direction of the electric field intensity at a certain point in the electric field is determined by the electric field itself, and has nothing to do with the charge.

2.2.2.2. *The electric field strength of a point charge in a vacuum*

If it is known that the charge of a certain point in vacuum is *q*, the magnitude and direction of the electric field intensity at a certain point r from this point of charge can be directly obtained by using Coulomb's law and the definition of electric field intensity:

$$\vec{F} = \frac{1}{4\pi\varepsilon_0}\frac{qq_0}{r^3}\vec{r} \quad ; \quad \vec{E} = \frac{\vec{F}}{q_0} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^3}\vec{r}$$

It can be seen from the above formula that the field strength of a point charge in a vacuum is determined by the field source charge that generates the electric field and the distance between the point and the field source charge. The square of the distance of the source charge is inversely proportional and has nothing to do with the test charge; the direction of the field strength is along the line connecting this point with the point where the field source charge is located.

Characteristics of electric field strength: the closer to the field source charge, the greater the field strength; the field strengths of all points on the same sphere are equal and spherically symmetric; the direction of the field strength around the positive charge diverges outward, while the direction of the field strength around the negative charge Converge inward; the field strength directions of each point on the same sphere are different, and they are along the sphere diameter where each point is located.

2.2.2.3. *The electric field strength of the electric field of the point charge system in vacuum*

Assuming that there is a point charge system composed of many points charges q_1、q_2...q_n in a vacuum, the calculation of the electric field strength of the point charge system can lead to the superposition principle of electric field strength from the principle of superposition of forces:

$$\vec{E} = \frac{q_1}{4\pi\varepsilon_0 r_1^3}\vec{r}_1 + \frac{q_2}{4\pi\varepsilon_0 r_2^3}\vec{r}_2 + \cdots + \frac{q_n}{4\pi\varepsilon_0 r_n^3}\vec{r}_n$$

$$= \sum_{i=1}^{n}\frac{q_i}{4\pi\varepsilon_0 r_i^3}\vec{r}_i$$

Namely: $\vec{E} = \sum_{i=1}^{n}\vec{E}_i$

Conclusion: The electric field intensity at a certain point in the electric field excited by the point charge system is equal to the vector sum of the electric field intensity excited by the point charge when each point charge exists alone.

2.3. *Curriculum Ideology*

Through the study and discussion of this lesson, we summarize the ideological and political elements that can be incorporated into the course as follows:

(1) Cultivate students to establish scientific materialism. The world is made up of matter, and matter is made up of invisible particles, and the particles never stop moving. Both the macroscopic object, the microscopic world, and the entire universe are composed of moving matter. Through the teaching of the concept of field, students' understanding of the world is transformed from physical material to field material, which expands the scope of students' cognition and cultivates students to establish a scientific view of matter.

(2) Cultivate students' scientific spirit. By explaining the cognitive process of the interaction between electric charges in the history of physics, students can experience the hardships of the research process of physical laws, cultivate students' spirit of pursuing truth and courage to explore, and form correct scientific views.

(3) Cultivate students' scientific attitude of seeking truth from facts. In the process of introducing the concept of electric field strength, different experimental methods were used. Through the recording and comparison of various experimental data, it was emphasized that physics is a science based on experiments. The experimental data must be respected. It is strictly forbidden to tamper with experimental data for experimental purposes, and learn to discover and analyze unreasonable data, raise students' awareness of "big country craftsmen", further cultivate students' rigorous scientific attitude and scientific thinking methods, and lay the foundation for students to develop good attitudes in future work and scientific research.

(4) Cultivate students' knowledge transfer ability. Through the introduction of the concept of electric field strength, students are guided to use the existing knowledge of Coulomb's law to derive the formula for calculating the electric field strength of the electric field around a point charge in a vacuum.

(5) The image of the spatial distribution of the tree stand and cultivate spatial imagination. Through the analysis of the characteristics of the electric field strength of the positive and negative charges, feel the beauty of the symmetrical distribution of the field strength of the point charge, which inspires students' deep love for science.

(6) Practice to test the truth. Physics itself is a science-based on observation and experiment. The knowledge in physics class is the "indirect experience" summarized by the predecessors, not the "direct experience" compiled by the students themselves. By playing experimental phenomena or doing related experiments in the teaching process, students are guided consciously and purposefully to understand that practice is the only criterion for testing truth and the source of knowledge.

(7) Things are universally connected. Dialectical materialism believes that things in the world are diverse, complex and diverse, but they are not isolated. There are certain interconnection between things. For example, the

electric charge is affected by the electric field force in the electric field of the field source, indicating that the electrical phenomenon is related to the mechanical phenomenon; many similar examples can be cited, such as frictional heat generation, which illustrates the connection between mechanics and heat; and electric current generates heat through an electric heater, which indicates that electrical phenomena are related to thermal phenomena.

(8) The dialectical relationship between internal and external causes. By explaining the concept of electric field strength, students are guided to think that external factors are conditions of change, and external factors cause effects through internal factors. Certain results are caused by certain reasons, and certain reasons inevitably produce certain results. For example, voltage causes current to be formed in the circuit, that is, voltage causes free charge in the circuit to move directionally, where the external cause is voltage, and the internal cause is free to charge. Free electric charges usually do chaotic thermal movement, and it is impossible to cause directional movement to form electric current. Once voltage is applied to them, these freely moving electric charges can be forced to move directionally and form electric current. If a voltage is applied to both ends of an insulator, there is almost no free charge moving in the insulator, so no current can be formed.

3. SUMMARY

The organic integration of ideological and political elements in the college physics curriculum does not mean that the college physics course is taught as an ideological and political course, nor does it mean that the course ideological and political is generally discussed at the end of a class or a certain knowledge point. In the knowledge transfer process, we can reasonably choose and expand the corresponding ideological and political elements according to the knowledge points of each lesson. This article uses the electric field strength as an example to illustrate how to excavate the ideological and political elements in the course. Enhance students' patriotism, enhance their self-confidence and pride, improve their ability to analyze and solve physics-related problems, etc. However, how to organically combine the ideological and political elements of the curriculum and theoretical knowledge in classroom teaching requires further research and practice.

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