

Reconfiguration of college physics teaching based on the "Trinity" education model

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Abstract. College physics not only carries the task of learning basic knowledge for science and technology students, but also plays a deep role in educating students through thinking and politics. It has irreplaceable nurturing functions in cultivating students' ideals and beliefs, cultivating national sentiments and strengthening scientific thinking. In the process of education and teaching, we insist on the "trinity" education mode of ideologies, mindset and knowledge, cultivating people with ideologies, reshaping people with thinking and enlightening people with knowledge. Thus, we maximize the effect of "teaching" and "learning". A new form of university physics teaching is built by optimizing teaching resources and reforming the teaching mode, based on the characteristics of the curriculum and the students. Therefore, we realize the knowledge transfer to value leadership from teaching knowledge, and truly implement the fundamental task of moral education.

1 Cultivating students by curriculum ideology and politics

College physics is based on improving the physical ability and thinking of students majored in science and engineering, inspiring their innovative consciousness and spirit of exploration. It takes physics knowledge as the carrier, is driven by the two wings of "physics history + philosophical thinking", and takes the six main lines of "physics spirit, academic frontier, scientific and technological innovation, cultural inheritance, value concept and historical materialism" as the approach. It contains the dialectical unity of physical thoughts such as overall analysis and synthesis, induction and deduction, abstraction and concrete, history and logic. We take the classroom as the battlefield, the integration of ideological and political elements as the method by the 'student-centered' vision. Many teaching methods are taken to create a strong momentum of ideological and political education in the course, resulting in the achievement of the effective education effect. Therefore, it cultivates the professional talents of science and technology with both virtue and ability.

1.1 Selecting ideological content to sublimate physics

(1) The role model of scientists to achieve ideological and political education. We introduce the famous physicists' life stories and scientific research processes into the course, to cultivate

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the scientific spirit of loving science, courageous spirit and perseverance of the students. (2) Scientific and technological achievements at the forefront of the world are introduced, such as aerospace, quantum communication, deep-sea exploration and other leading scientific achievements. These can enhance students' national pride and sense of national honor, stimulate students' patriotic enthusiasm, and guide them to learn more knowledge. (3) Exploration of the philosophical principles in physics knowledge. The research content of physics comes from the Marxist concept of matter, such as relative motion, and the relationship between time and space. We use the philosophical principles contained in the knowledge to train students' historical materialism effectively. (4) Pay attention to the cultivation of students' innovative spirit. The dynamic frontier of science and the application of physics knowledge in production and life are brought into classes. It broadens students' vision and leads them to establish the connection between basic knowledge and practical application.

1.2 Expanding the civics method into teaching

We explore the ideological and political thinking in college physics courses from 2016. With "three minutes in class" as the main approach, we diversified curriculum knowledge and three-dimensional class gradually. Then we integrated different teaching methods according to the teaching content and ideological and political elements. For example, in relative motion learning, the scene of automatic rendezvous and docking between Shenzhou-11 manned spacecraft and Tiangong-2 space laboratory is created for students. During students' "immersive", we simulated the process of docking of the two relative speeds, motion state, motion trajectory, etc. The students could "control" to achieve data fitting and complete the docking between Shenzhou and Tiangong. In the teaching process, students can not only feel the advanced aerospace technology of the motherland, but also have a deeper understanding of the speed of circular and relative motion of objects, leading to the silent education effect in diversified teaching.

1.3 Improve the effectiveness of education to help students achieve success

In the ideological and political implementation, we always adhere to the "student-centered" principle and give full play to the main role of students in the setting of teaching content and the selection of ideological and political elements. (1) Both knowledge and teaching methods are included to serve the goal of talent training. (2) The ideological and political elements are properly integrated into the teaching process. Whereby, the course research is the "support", the course material is the "carrier", and the ideological and political implementation is the "method", to form a three-dimensional curriculum. (3) Think what students think, to produce the course ideological and political education process into a vector based on the characteristics of students' personalized growth, such that students are easy to accept, resulting in the improvement of their growth.

2 Mindset reconfiguration shapes students

In college physics teaching, the research and practice of teaching reform based on mindset-based education (MBE) are explored to consolidate students' basic knowledge and shape their physical thinking. In the process of knowledge teaching, the training of physical thinking mode is targeted, the modular teaching content is designed, the role of basic physics discipline is given, the science and technology literacy of students is cultivated, and the thinking reconstruction is shaped to educate students, respectively.

2.1 Highlight MBE physical teaching concept

The teaching concept based on mindset-based education (MBE) is explored centering on the curriculum goal of combining "knowledge imparts" and "value leads". We research physics teaching content optimization, teaching module reorganization and teaching evaluation. We pay attention to the physics connotation and thinking elements of courses in the education process, and try to build an education system combining "physics knowledge" and "physical mindset". Finally, we build physics teaching into a logical and mindset-oriented course.

2.2 Advancing knowledge modules to build mindset connections

With the characteristic of modularization of college physics knowledge, the teaching partition is reset, and the knowledge system is reconstructed according to the classification of different knowledge corresponding to different thinking modes, to promote students' knowledge learning and thinking ability. According to the content of physics knowledge, we help students to shape their thinking frame from the perspectives of mathematical quantification thinking, model-building thinking, induction and summary thinking, and special general thinking. For example, when teaching the concept of "velocity" in particle kinematics, the introduction from average velocity to instantaneous velocity requires an infinite reduction of time, which is related to the limit of mathematics and the derivation of differentiation. Therefore, "calculus" is taken as the main line to connect the physical phenomenon and essence, make the physical phenomenon mathematical and quantitative, and guide students in quantitative analysis. The use of calculus tools to achieve the understanding of physics knowledge.

2.3 Expanding teaching methods to promote the development of mindset

The cultivation and exercise of mindset can't only rely on one-way linear transmission, but must be combined the characteristics of knowledge chapters and students' learning mentality. Through cases, interaction, reversal and other methods, students can take the initiative to learn, establish connections and shape their thinking in the process of participation. We guide students to build a course knowledge tree, and fill contents in them after each part of knowledge. The students can break through "two veins" of physics learning, and classify the thinking methods contained in physics knowledge through horizontal and vertical integration. By combining knowledge with new methods and ideas, students can improve their learning initiative and timeliness.

3 Knowledge transfer to enlighten people

Basic knowledge of science and technology is taught in college physics, with the classroom as the main channel, teaching resources as the basis, and knowledge transfer as the way. Such that the foundation of science and technology knowledge and literacy of students are consolidated.

3.1 Optimize teaching resources to improve the relevance of professional programs

We optimize the teaching resources suitable for the personal development of different science and technology students. Updating the rigid textbooks into a dynamic and diversified system of "textbooks-Internet resources-discussion materials-papers" to encourage students to

master the knowledge and stimulate creativity through independent thinking and data retrieval. For example, for students majoring in environment and chemistry, when teaching electromagnetic fields with a mass spectrometer, we introduce the application of such testing equipment in isotope testing and soil remediation testing, so that students can feel the practical use of learning.

3.2 Reforming the teaching model and advocating the integration of physics into the times

According to students' development needs, we set up videos of knowledge points that are integrated with current technology applications, and dynamic static course knowledge, insist on corresponding video points for difficult chapters taught in class to give students flexible materials for review in class. During the educational process, we promote students' understanding and application of knowledge through exercises and training, group discussions, microlearning resources, and student explanations. Quantum physics contents involve Compton scattering, photoelectric effect, etc., which are interesting knowledge points, so we assign the teaching task of the lecture to students. Students prepare in advance, then they teach and explain the knowledge points, background and physical scenes in groups, which not only increases students' mastery of knowledge, but also improves students' ability to sort course knowledge, prepare lecture PPTs and express themselves in the class.

3.3 Reinforce classroom teaching and focus on real-time feedback

As a basic course of science and engineering, college physics is still mainly taught in class. During the teaching process, we rely on internet platforms such as Rain Class and Super Star to interact with students, including 1. The storage and playback functions of courseware enable students to access the platform at any time; 2 Exercises in class after explanation of difficult knowledge points, and check the students' general results with feedback in real-time; 3 online testing after the end of a module to let students evaluate their learning effect; ④ Inter-evaluation of course papers can not only help students to learn with each other, but also check their learning Status. Which promotes the dynamic learning process, and improves the participation of students and knowledge mastery degree effectively.

4 Conclusion

College physics not only carries the task of learning basic knowledge for students majored in science and engineering, but also plays a deep role in educating them in the basic course of thinking and politics. It has irreplaceable significance in educating students in cultivating scientific knowledge, ideals and beliefs, cultivating national sentiment and strengthening scientific thinking. The course teaching is like a battle, which requires not only pre-battle preparation, but also battlefield struggle and post-battle summary. We should insist on the "student-centered" concept, teach knowledge to enlighten them with mindset, thinking and knowledge of the "trinity" education model. Therefore, we teach students with curriculum ideology and politics, physical mindset and useful knowledge. What's more, we want to create a course of education full of energy and enthusiasm, to achieve the effect of training students in silence. By creating a new form of college physics teaching, we could realize the key task of establishing moral education from knowledge transmission to value leadership.

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