

Research on middle school physics teaching based on STEAM Education Concept

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Abstract: This paper analyzes the origin and development of STEAM teaching concept, the development status of STEAM education in China, and points out the application of STEAM education concept in middle school physics teaching. Through the integration of STEAM education concept and teaching cases, students' all-round development is cultivated.

1. The connotation of STEAM education concept

STEAM evolved from the idea of STEM education. STEM is an education program proposed by the United States to improve its international competitiveness in accordance with the characteristics of the era of knowledge economy. It solves practical problems through the comprehensive application of disciplinary literacy and cultivates comprehensive talents at the same time. In STEM, "S" stands for Science, "T" for Technology, "E" for Engineering, and "M" for Math. As scholars carry out in-depth research on STEM education, they find that the application of science and technology is inseparable from creative ability, so STEM joins "A" and develops into STEAM. "A" stands for art, which is the key to STEAM's innovative educational ideas. "STEAM" education plays a very important role and significance in cultivating comprehensive innovative talents.

The combination of STEAM education concept and physics teaching in middle school is of great significance. First of all, STEAM concept regards "science" as the first implementation element of the concept, emphasizing the cultivation of students' scientific literacy and enabling students to form rigorous scientific thinking in teaching. Secondly, "technology" is the basis for students to start exploration experiments, which can help improve students' practical ability and practical ability; The concept of "engineering" can be seen everywhere in the process of science teaching in middle school. Through the integration of engineering and physics teaching in middle school, students can discover physics in life and learn to think independently. "A" stands for aesthetic feeling. When middle school physics teaching is connected with art, students can feel the beauty of physics and are more willing to explore and innovate. And "M" is the key for students to form rational thinking in physical inquiry. Science can only be truly scientific through precise quantitative calculation of mathematics. Therefore, STEAM can effectively improve the interdisciplinarity, experience, context, collaboration, artistry and design of physics classroom teaching in middle schools, and is an effective means to cultivate students' innovation ability, practical ability and comprehensive accomplishment.

Therefore, teachers should integrate STEAM concept into middle school science curriculum in educational activities to solve practical problems and cultivate students' physical concept, scientific

thinking, innovation ability and scientific exploration ability. Establish a scientific middle school physics STEAM teaching system, and effectively connect the stages of STEAM education, so as to better achieve the teaching goal of improving students' physical practice.

2. The integration of STEAM sections and middle school physics teaching

2.1 Science

From the point of view of core quality of physics discipline, physics teaching in middle school aims to cultivate future talents with physics concept, scientific thinking, scientific inquiry, scientific attitude and responsibility. The STEAM concept regards "SCIENCE" as the first implementation element of the concept, emphasizing the embodiment of students' scientific literacy and scientific thinking in teaching. This teaching concept echoes with the requirements of physics in middle schools. Therefore, the integration of STEAM teaching concept and middle school physics teaching is inevitable.

Take the teaching of "law of universal Gravitation", a compulsory course of high school physics in human Education Edition, as an example. Teachers can lead students in the course introduction to the successful launch of "satellite 5", which is a hot fact, to design the orbit motion situation of the satellite, and inspire students to explore the knowledge of universal gravitation. Before the teaching, the teacher can lead the students to guess the motion state of "satellite 5" after entering the space, lead the students to build the model of satellite circling the earth, and analyze the knowledge points needed to describe the state of satellite circling. Based on STEAM principles, teachers can design a new teaching mode from questioning to inquiry, and then to derivation, so that students' thinking becomes more active. This teaching method can promote students' scientific logical thinking, and students will be more active in learning the knowledge points later, which is also conducive to consolidating the knowledge points.

2.2 Technology

The vigorous development of middle school physics teaching can not be separated from the support of technology. The lack of technology will lead to the development of the physics classroom is greatly reduced. The improvement of science and technology can improve students' ability of scientific inquiry, display cutting-edge physical achievements through technology, and participate in physical experiments through the network can also broaden students' horizons and stimulate their love for science and technology. If students can be familiar with the integration of physics and technology in the process of physics teaching, it can also help students find the technology around them more easily, observe life with scientific thinking, and explore the technology often used around them.

Take the teaching of "the synthesis of force" as an example. When telling the common point force, when students are familiar with the point, the teacher can connect the physical points with the technology, to provide conditions for students to deepen their understanding of the knowledge. Teachers can use the laptop base as teaching AIDS, in the process of adjusting the notebook card, ask students about the stress analysis between the laptop and the heat dissipation base. Linking physics knowledge with relevant technologies around students helps students to deeply understand the connection between physics and technology, stimulate students' motivation and interest in learning physics, and also helps students to learn, consolidate and apply physics knowledge in real life.

2.3 Engineering

One of the core qualities of physics is to cultivate students' scientific attitude and responsibility, which requires them to understand the relationship between science and technology, society and environment. And the most direct bridge between physics and society is through engineering. Physics is everywhere in engineering. If teachers can combine physics knowledge and engineering in the process of physics teaching, cultivate students' engineering thinking and help students expand their physics knowledge outside the classroom, students can have a better understanding of the importance of physics and experience engineering in life.

With high physics compulsory 2 "life circle" teaching as an example, the students are familiar with the theory of circular motion after knowledge, the teacher may contact engineering in life, to train in a straight line and turning force analysis, guide students to think outside the reason of the high in low orbit, understand the importance of engineering and physical contact, In order to further train students' engineering thinking, teachers can lead students to think deeply about how to design a railway in the mountains, given the limited power of the train, and provide students with relevant information about the "herring-shaped" railway after active discussion, to expand students' thinking. In physics courses for high schools are 3-2 "electricity transmission" teaching, the teacher should also contact the actual, direct current transportation and alternating current (ac) is given the respective advantages and disadvantages, and with the development of science and technology, the change of our transmission mode, let students understand the engineering technical progress is closely related to the renewal of the physical, to cultivate the students' interest in engineering thinking and physics.

2.4 Art

If students can obtain not only the satisfaction after learning knowledge, but also visual and emotional enjoyment in middle school physics teaching, it will greatly deepen students' desire to explore knowledge. The integration of ART and middle school physics teaching is to make students feel the wonder of physics in the charm of beauty and be attracted by physics. Therefore, teachers should pay attention to the aesthetic feeling of teaching design and experiment, guide students to discover the artistic beauty of physics in the process of participating in physical exploration, promote students' yearning for physics, and stimulate students' creative thinking.

Take the teaching of 3-4 "Light interference" as an example. In the previous teaching activities, teachers often used video teaching demonstration experiments to explain the knowledge point of light interference, which made the learning process of students boring and lacking of learning initiative. But if the teacher can demonstrate the double-slit interference experiment with a laser in class, walk from the back of the laboratory to the front along the overlapping area of the two beams of light with a glass plate affixed with translucent paper, so that the students can clearly see that the distance between the interference stripes becomes smaller and smaller. Then a sprayer is used to spray water mist over the superimposed area of the beam. By using the scattering of light from the small water droplets, the three-dimensional interference pattern can be observed in a larger space. This from static to dynamic, from the plane to the three-dimensional experimental demonstration, must be able to deeply attract students, stimulate the study of physics interest, mobilize the desire of students to learn.

2.5 Mathematics

The essence of mathematics is rational and logical thinking. Introducing mathematics into the teaching process of middle school physics can deepen students' thinking and logic. By deepening students' thinking about mathematical problems and physics, students can form a complete problem solving process. Therefore, when STEAM teaching theory is integrated into middle school physics

learning, mathematics can be integrated into teaching, and the rational thinking of mathematics can guide students to feel the core charm of physics.

In physics compulsory for high schools are a "uniform variable linear motion study" comprehensive recitation, for example, teachers can guide students to use mathematics method of coordinate axis to handle this problem, image is mapped to the reality of the situation of the problem or $v - t$ image, by understanding and analysis we can draw a curve slope clearly said the acceleration curve and area of the shadow of the said, Or the tension in the circular circular wire in the magnetic field or electric field can be introduced into the micro element method in mathematics, and the research object can be divided into many small elements for analysis, so as to solve the problem. Therefore, adding mathematics knowledge into the process of physics teaching can help students stimulate the activity of thinking and cultivate radiation thinking. Students can also enjoy the process of solving problems and improve their confidence in physics.

3. Teaching revelation

The process of China from explicitly proposing STEAM teaching to upgrading STEAM teaching from "soft task" to "hard target" shows that STEAM teaching concept is very consistent with the characteristics of China's education development. However, the application of STEAM in middle school physics teaching is extremely rare. The main reason is that teachers are not clear about the advantages of STEAM and the application of each module of STEAM teaching concept in the teaching process. So teachers should analyze the STEAM each plate, the import link, teach new lesson, in brief summary, consolidate the practice link to join the STEAM, all-round development of students' core accomplishment and advanced thinking, improve students' ability to solve practical problems, to help students become comprehensive talents conform to the requirements of The Times to do adequate preparation.

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