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# Application Strategies of Steam in High School Physics Experiment Activities

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**Abstract:** At present, China attaches great importance to quality education, and the teaching requirements for educators have changed. It is not only necessary to impart subject knowledge to students, but also to focus on cultivating students' comprehensive abilities. Based on this situation, traditional teaching strategies can no longer meet modern teaching tasks. Educators need to actively innovate teaching strategies, focus on students' practical ability, and teach students the ability to solve practical problems. Among them, the learning pressure in high school is relatively high. When conducting physics experiment classes, teachers' design of teaching content is relatively unscientific. Teachers need to continuously apply STEAM education concepts to teaching activities to maximize the teaching efficiency of teaching classes. Therefore, this article will analyze the application of STEAM in high school physics experiment activities, and give corresponding teaching activity development strategies to provide professional advice for those engaged in education.

**Keywords:** STEAM; high school physics; experimental activities; application strategies

## Introduction

At the current stage of further deepening of education reform, China has made new requirements for the overall education of students, and has also made corresponding adjustments to the educational direction of high school physics, paying more and more attention to high school physics experiments. High school physics experiments are one of the most important parts of the overall learning of high school physics and are the basis for students to learn physics knowledge [1] . In current high school physics teaching, teachers' teaching ideas are relatively backward, and the teaching methods used are extremely simple and repetitive. They cannot mobilize students' learning enthusiasm, stimulate students' subjective initiative, and let students actively participate in teaching activities. This is not conducive to students' learning of physics knowledge and also inhibits the improvement of students' comprehensive ability in high school. Based on this situation, in the implementation of quality education, the STEAM teaching concept was proposed by educators, which was sought after by high school physics teachers and widely used in high school physics teaching classes, and achieved good teaching results. Therefore, the organic combination of the current STEAM teaching concept and high school

physics experimental teaching has become the content of modern physics teachers' exploration. High school physics teachers need to continuously improve their teaching model to achieve the best teaching effect and improve students' subject literacy .

## 1. Problems in the Current High School Physics Experiment Teaching

### 1.1 Teaching concepts need to be updated

In high school physics experiment teaching, most teachers' traditional teaching theory regards themselves as the main body of the class when explaining physics experiments, and students can only passively learn knowledge. This leads to students' shallow understanding of physics knowledge and no in-depth thinking about it [2] . After explaining the experimental steps, teachers ignore the cultivation of students' hands-on ability, believing that letting students conduct experiments by themselves is a waste of teaching time, which affects the teaching progress and also affects students' learning efficiency. At the same time, high school physics teachers will design some physics problems related to the experiment, hoping to improve students' understanding of knowledge with the help of the "sea of questions" teaching method. However, when students have not fully mastered the physics experiment and have only a partial understanding of its principles, doing some exercises will only make students feel that physics knowledge is difficult to learn, and gradually they will have less interest in learning physics knowledge, and may even feel bored. At the same time, teachers fail to cultivate students' comprehensive literacy and only focus on the level of teaching results, which is not in line with the teaching concept of the new curriculum reform.

### 1.2 Over-emphasis on physics experiment teaching

Under the background of education reform, high school physics teaching attaches great importance to experimental content. High school physics teachers are influenced by this policy and actively carry out physics experimental teaching activities. However, some problems are exposed in the actual teaching process, which need to be continuously improved and improved by high school physics teachers to enhance the teaching efficiency and quality of high school physics experimental teaching [3] . At present, some high school physics teachers believe that students can conduct experiments better if they have a strong theoretical foundation. Therefore, before conducting experimental teaching, they will spend a lot of time to transfer too much basic theoretical knowledge to students, leaving students with less space for experimental exploration and unable to exercise their independent exploration ability. Some high school physics teachers, in order to make students' experiments go smoothly and improve their experimental efficiency, give students too much guidance on the experimental process. Under such teaching methods, students can smoothly carry out experimental operations and quickly complete physical experiments. However, too much intervention in students' experimental process prevents students from exercising their various abilities, which is extremely unfavorable to the formation of students' core literacy.

### 1.3 Less use of new technologies

In today's society with the rapid development of our country, teachers have realized the need to apply advanced teaching equipment to teaching classrooms to mobilize students' curiosity and focus students' attention on the teaching content. However, most of teachers' use of technology is multimedia teaching equipment, and other teaching methods are rarely used, and the teaching effect on students is not significant [4] . At the same time, because teachers have less understanding of new technologies, they cannot fully master them, and they have less use of new technologies.

## 2. Steam Education Concept in High School Physics Experimental Teaching

What is STEAM? In fact, it is the abbreviation of science, technology, engineering, art, and mathematics. Simply put, this kind of education is a comprehensive education that combines the above elements.

The characteristics of this theory are obvious. It emphasizes diverse scenarios, completes the cross-border of knowledge, highlights the integrated curriculum, and is also practical and active. It shows that classroom teaching must eventually return to natural life. Therefore, applying this theory to high school physics experiment teaching is to apply knowledge from multiple fields such as science, technology, engineering, art, and mathematics to physics experiment teaching classes, which can not only broaden students' horizons, but also promote their all-round development. In particular, using

scientific and technological, artistic thinking, etc. to build experimental models and evaluate experimental results can exercise students' logical thinking and allow students to form the habit of thinking about problems in a diversified way, thereby improving students' physics literacy and laying a foundation for students' future development in the field of physics.

## 3. Application Strategies of Steam in High School Physics Experiment Activities

### 3.1 Improve concept cognition and build teaching model

At present, high school physics teachers are still mainly based on traditional teaching methods due to the influence of exam-oriented education. When teaching, teachers mainly impose knowledge on students. Students can only passively accept knowledge, and their participation in physics experiment courses is too low, which makes it easy for students to shift their attention from the classroom to other places, resulting in low learning efficiency [7] . Applying the STEAM education concept to physics experiment teaching classes can help attract students' attention, make students willing to participate in experiments, and make students devote themselves to the teaching class, deepening their understanding and cognition of knowledge. Based on this situation, if we want to better integrate the STEAM education concept with the physics experiment teaching class, we cannot do without the role of high school physics teachers. First of all, high school physics teachers should keep up with the teaching requirements of the times, actively change their teaching ideas, break through the constraints of traditional teaching models, find teaching models suitable for students in the wave of education, and build a new era of education concepts. Only when teachers realize the importance of STEAM theory can they better perceive the role of this education concept in the teaching classroom, explore and think about it, and reasonably apply it in teaching activities.

However, at the current stage, most high schools and teachers in China are not doing well in this regard , and corresponding improvements and upgrades are needed in this regard . Based on this scenario, high schools should do a good job in education support, regularly organize teachers to learn new educational methods and concepts, and hire some professional professors from outside the school for training. At the same time, the school should also organize some seminars for teachers to communicate with each other, explore better educational concepts, learn from each other's educational methods, and better integrate STEAM education theory into high school physics experimental teaching classes [8] . As a high school physics teacher, you must take the initiative to improve your professional skills and literacy, and use modern Internet teaching resources to expand the study of STEAM education concepts, so as to build a good teaching model for students and cultivate students' all-round development.

### 3.2 Designing courses based on students' subject literacy

High school physics is a natural science subject. The teaching content mainly studies the phenomena, forms, properties and laws of motion of various substances in nature. At the same time, detailed research is also conducted on the internal structure of substances. Therefore, high school physics experiment teaching is a process of students exploring knowledge. It is mainly to cultivate students' scientific literacy. This teaching goal corresponds to the "S" science in STEAM education theory [9] . Based on this situation, when teachers integrate STEAM education theory into the teaching of high school physics experiments, they should focus on the cultivation of students' scientific literacy and design teaching content. At the same time, when conducting experimental teaching, high school physics teachers should provide appropriate guidance to students, let students complete the experiment, explore the experimental process and results, and be able to apply the knowledge they have learned to solve practical problems, so as to gradually approach the teaching goal and enable students to better understand the content of physics knowledge. After the experiment is completed, the teacher needs to let students discuss the experimental process and results in groups so that students can express their own ideas. This can help teachers grasp the acceptance of knowledge and correct some students with deviations in experimental ideas. In this way, students can not only have a deep understanding of knowledge, but also cultivate their scientific literacy and improve their comprehensive subject ability. This teaching method is in line with the requirements of the education reform of the times,

allowing students to combine their hands and brains. Students can complete knowledge exploration during experiments, making students more fond of this teaching course.

For example, when teachers conduct the first section of the second chapter of the first volume of the People's Education Edition of the high school physics compulsory course "Exploring the law of the change of the speed of the car over time", teachers need to prepare the tools used for the experiment for students, use multimedia teaching equipment to play experimental pictures and experimental videos, and guide students to conduct experiments according to the teaching pictures in the textbook. The placement of experimental equipment is shown in **Figure 1**. First, place a longboard with a pulley on the experimental table, and the pulley extends outside the table. Fix a dot timer on the side of the longboard without a pulley. Secondly, tie the car with a thin rope and let the thin rope cross the pulley. Hang an appropriate amount of weights below, let the paper tape pass through the dot timer, and fix the other end of the paper tape on the car. Finally, put the car against the dot timer, and when the power is turned on, let go of the car to move. At this time, the car drags the paper tape. As the movement, the dot timer will make a row of small dots on the paper tape, and replace the new paper tape to repeat the experiment three times. Then increase or decrease the mass of the hooked code, change the paper tape, do two more experiments, and record the experimental data. However, the experimental process is prone to some problems due to improper operation of students, incorrect selection of experimental equipment, etc., as shown in **Figure 2**. Students conduct their own experimental operations, analyze the traction of the trolley on the heavy object, discuss the changes in its speed and time, deepen their understanding of knowledge, effectively improve their inquiry and practical ability, and improve their subject literacy.

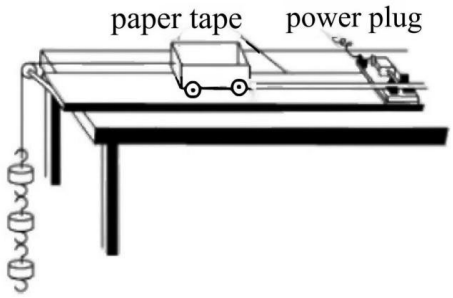


**Figure 1**

**Figure 2**

| | Possible problems: | |
|---|---|---|
| Question 1 | Display problem: A part of the paper tape has no dots, and the time interval between the dots appearing is quite long. Turn on the large dot timer . | Analysis of the cause: release the car first, then . |
| Question 2 | Demonstration problem: A section of paper tape has no dots, but at the beginning the dots are dense and even overlap . | Analysis of the cause: The released parking space is far away from the timer . |
| Question 3 | Demonstration problem: The hook is very close to the ground and will fall to the ground during the experiment . | Analysis of the cause: The thin line is too long . |
| Question 4 | Display problem: The paper tape is twisted . | Analysis of the cause: The dot timer is not facing the center of the track . |

### 3.3 Integrate knowledge from different fields based on textbook content

The most significant feature of STEAM education theory is the integration of knowledge from different fields. Before carrying out physics classroom teaching, teachers should combine the teaching content, explore the knowledge of various subjects, and design it in physics experimental teaching activities, so that students' knowledge systems can be built more closely and students can develop in a diversified way [10] . High school physics teachers can integrate the knowledge in various fields that students have learned, organically combine it with the teaching content, and design experimental teaching content suitable for students, so that students can explore physical knowledge in experimental teaching activities and participate in activities. It can consolidate knowledge in other fields, gain new insights into knowledge, and play a positive role in the good development of students.

For example, when teachers are conducting the course "Overweight and Weightlessness" in the fourth chapter of the first volume of the People's Education Edition of the high school physics compulsory course, they need to fully analyze the content of this lesson, integrate it with the knowledge of other subjects, and then design the teaching content of the teaching class. The learning task of this lesson is arranged after students have learned the relevant knowledge of Newton's laws of motion. It is a typical example of

applying laws to analyze phenomena in the process of high school physics learning. The teaching goal of this lesson is to enable students to not only have a deeper and more essential understanding of Newton's laws of motion, but also stimulate students' interest in learning physics, and effectively cultivate students' ability to analyze and solve problems. Before the formal teaching activities, teachers can: "Most of the students have gone to the amusement park to ride the bungee jumping machine. What do you feel when you ride the bungee jumping machine?" Student 1: "It will be very scary", Student 2: "My heart will feel a little uncomfortable." Teacher: "That's because our bodies will lose weight when we play the bungee jumping machine. Today we will study the lesson "Overweight and Weightlessness" to explore the phenomenon of overweight and weightlessness." The teacher can simulate the elevator to demonstrate the experimental process first, and then guide students to imitate the experiment. Divide students into several groups to carry out effective experiments, make effective observations during the experiments, record the experimental data, and let students explore the phenomena of overweight and weightlessness based on the experimental data, so that they can have a deep understanding and mastery of the knowledge related to overweight and weightlessness.

### 3.4 Conduct teaching activities based on information technology teaching resources

In the new era, with the continuous reform of education and the steady development of society in China, China attaches more and more importance to education. Teachers' teaching concepts also need to be constantly updated , and the new teaching concepts should be combined with classroom teaching to adapt to the cultivation of modern talents. At the current stage of the continuous development of information technology in China, information technology teaching resources have been applied by educators in teaching activities, but the application of high school physics experiment teaching classroom is relatively small, and it cannot improve students' learning efficiency. In the integration of STEAM education theory and high school physics experiment teaching classroom, teachers should keep up with the pace of the times and apply information technology teaching resources to teaching, which will play a good role in the integration of STEAM education theory . There are many teaching methods contained in information technology, and teachers can flexibly use them in teaching activities. For example, teachers can use micro-classes to provide convenient conditions for students to preview, review, and consolidate knowledge after class. At the same time, teachers can also record the physical experiment process in the form of micro-classes, so that students can observe and explore the experiment in detail after class, which is conducive to students' learning of physical knowledge.

### 3.5 Focus on diversified evaluation and build students' self-confidence

In the traditional teaching process , teachers evaluate students mainly based on their test scores. This evaluation basis is relatively one-sided , cannot stimulate students' interest in learning , and cannot play a good role in students' learning . In addition, the physics course in high school is difficult and it is difficult for students to learn . Teachers should give students more good evaluations to improve their learning interest and build their self-confidence, which will help students learn better and have the courage to solve the difficulties encountered in physics learning. Under the STEAM education theory , high school physics teachers should adopt a diversified evaluation method for students in the teaching process , conduct a comprehensive evaluation of students , and enable students to truly recognize themselves.

In the process of high school physics teaching, teachers usually let students discuss problems , deduce theorems, and conduct actual physical experiments in groups. Based on this situation, first of all , teachers can guide students in the same group to evaluate each other , which can reflect the most real classroom status of students. Secondly, teachers guide students in different groups to evaluate each other , evaluate students ' experimental processes and results from a competitive perspective , and let students learn from each other's learning experience . Finally , teachers evaluate students' performance, praise students with good performance in a timely manner, and correct wrong behaviors for students with poor performance . This evaluation method is a diversified evaluation , which can better evaluate students' classroom performance, allowing students to correct their own mistakes and ideological deviations in a timely manner under good evaluation , and improve students' comprehensive literacy in physics.

## Conclusion

In summary, education at the high school level in China has attracted more and more attention. By constructing a positive innovation method, students' potential abilities are fully mobilized, students' hands-on ability is trained, and students are promoted to develop in all directions, laying a solid foundation for their future development. Some educators have proposed to apply the STEAM concept to students' high school physics experiment teaching process, which has been sought after by high school physics teachers and actively applied in high school physics experiment activities. Its application not only helps students to carry out physics experiment activities efficiently, but also promotes the improvement of students' comprehensive literacy. High school physics teachers integrate STEAM education theory into physics experiment teaching classes, which can meet relative teaching requirements. Teachers should actively explore their teaching concepts, introduce new teaching methods into teaching classes, enrich students' teaching classes, stimulate students' subjective initiative, and better cultivate students' physics literacy.

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