The Impact of Extracurricular Delayed Services on Physics Teaching in Secondary Schools and Coping Strategies

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Keywords: After-school delay service, Secondary school physics, Teaching mode, Subject teaching, Physics experiments

Abstract: This paper studies how to use the after-school delay service for middle school students in developed countries in Europe and the United States to improve the learning efficiency of middle school students' physics on the premise of reducing the burden of schoolwork; Analyze the learning effect of students through specific teaching cases; And collect and analyze the feedback information from students and parents. Finally, the conclusion is that after-school delay service activities have an impact on students' learning interest and academic performance.

1. Introduction

The United States has a long history of after-school services and has accumulated rich experience in educational services for the United States. Many scholars have studied the main projects of after-school services in the United States, including “academic counseling, interest and art guidance, health and safety education, career guidance and planning, stem curriculum teaching, community service, and so on”[1].

On July 14th, 2021, China issued the “double reduction” policy, banning out of school training institutions and reducing students' after-school burden, which led to the need for school classroom teaching to bear more tasks and the acceleration of classroom rhythm, which led to the inability of key classes and ordinary classes to teach students in accordance with their aptitude and the ambiguity of teaching levels[2].

This paper refers to foreign ways and methods of after-school service, and through specific activity design and result analysis, studies the use of after-school extended service time to carry out interesting physics experiments, improve the effect of physics teaching, stimulate students' interest in physics and consolidate their knowledge[3].

2. Activity Theme: “Water Rocket” after-School Delay Service Activity Design

1) Textbook analysis: In the second section of the ninth chapter of the ninth chapter of the 2012 edition of sujiao junior high school physics, “Force and Motion”, Newton's first law, before this lesson, students have learned the basic knowledge of force, mastered the effect of force and the knowledge of the balance of two forces, and then studied Newton's first law, introduced the “water rocket” experiment, and analyzed the knowledge contained in water rockets from different angles. This lesson is to learn about force and movement, and then show students an experiment that is both interesting and ornamental, and in this class, observation and analysis are made[4].

2) Academic analysis: In the second half of the second semester of the second semester of junior high school, students have learned some basic concepts and laws in mechanics, and have a certain ability to think about forces. The introduction of Newton's first law in the book, from the physicist Aristotle to Galileo to Newton, the establishment of Newton's first law took a long time, and students glided through different contact surfaces through trolleys in class, and then came to conclusions through experiments and reasoning, which was more abstract for students. This lesson is a new lesson in “Newton's First Law”, to a certain extent, students have understood Newton's first law, and use the knowledge learned to further analyze the experimental principles of water rockets.

3) Teaching mode: The teaching mode of this lesson is mainly explanatory and demonstration

  DOI: 10.25236/ieesasm.2022.012

visiting to help students better understand Newton's first law, and use the “water rocket” experiment to help students understand and apply this knowledge, so as to lay the foundation for further learning of pressure and buoyancy[5,6].

3. Teaching Process

The teaching process is shown in Table 1.

Table 1 Teaching Process

Teaching activities	Teacher activities	Student activities	Design ideas
New lessons are introduced	Reviewing what you learned in the previous lesson, how is Newton's first law defined?	Through the study of the previous lesson, students can answer the teacher's question: when the object is not affected by the force, it can remain stationary or move in a straight line at a uniform speed.	By reviewing what they have learned in the previous lesson, students can get into a state of learning new knowledge faster.
New lessons are taught	1.After learning Newton's first law, we know that objects remain stationary or move in a straight line at a uniform speed when they are not under force, so what does this sentence mean? 2.When we do experiments with stacked pieces, when we quickly hit the bottommost piece, the students pay attention to observe the experimental phenomenon and explain the occurrence of such a phenomenon. 3.In ordinary life, when we sit in a car, the car suddenly starts, people will lean back, when the car suddenly brakes, people will lean forward, so what is the reason for this phenomenon? 4.To sum up, we call the property of an object that remains stationary or remains constant in motion in a uniform linear motion inertia, and our Newtonian first law is also called inertia law. 5.Outside of class, the students will be shown the fun experiment “Water Rocket”, and the students will analyze the principle of water rocket lift-off and discuss it in groups.	1.After learning Newton's first law, students know that the original stationary object remains stationary, and the original uniform linear motion of the object still maintains a uniform speed of linear motion. 2.Students understand and explain the observed phenomena, the original chess pieces are stationary, the lower pieces are forced to fly out by the action of the ruler, and the upper pieces must remain in the original static state, so that the observed phenomenon occurs. 3.Students can understand that when the car suddenly starts, the human body is stationary, when the car suddenly starts, because the human body is forced forward by the action of the car chair, while the human head remains in its original stationary state, so the person will lean back. 4.Students in the previous case study, can get conclusions, the law of inertia. 5.Students conduct fun experiments on the playground to observe “water rockets”.	1.Through case studies, students are able to analyze problems independently and their thinking skills are improved. 2.While analyzing the problem, students can find common ground in several cases, so that they can summarize their own conclusions. 3.Under the leadership of the fun experiment “Water Rocket”, students can further understand this knowledge, and use this part of the knowledge to explain and apply. 
Activity Exploration	1.Students observe the fun experiment of “water rocket” on the playground. 2.Group discussion of the principle of “water rocket” lift-off. 3.Students understand that the water rocket liftoff, first of all, because the force is mutual, when the water flow is sprayed down, the force is downward, so that the water flow will have a reaction force on the	1.As students observe, they think about how the rocket lifted off and explain it using what they have learned. 2.For the forces to act on each other, students can clearly understand the reasons why water rockets fly upwards. 3.In applying Newton's first law, students know that if the water rocket is not subject to force, it	Students in the observation, for the water rocket lift-off, interest greatly increased, on this basis, analysis, students for the role of force is mutual, Newton's understanding and application of the first law has been further

	bottle, so it will be used to fly. 4.What does that have to do with our Newtonian First Law? Students think.	will fly upwards, so due to inertia, the water rocket will fly upwards, but eventually fall because of gravity.	improved.
Homework	So students, when our water rocket rises, what changes in its state of motion? Why does it fall the most? And pumping the bottle, what is the purpose?		After the class, I further thought about the "water rocket" and laid the foundation for the subsequent relationship between force and motion and the pressure.
Summary: Students in the learning of Newton's first law, although they know what Newton's first law is, but they are not skilled in its application, through the study of this lesson "water rocket", students have a new understanding of this aspect of knowledge, will use this knowledge to explain the phenomena in life, such as cars suddenly start, people will lean back; When the car brakes suddenly, it will lean forward, which is why the car needs to wear a seat belt and the car seat is equipped with a headrest. After learning inertia, the introduction of "water rocket" fun experiment, students have a very big interest in the experiment, and will use the knowledge learned to explain, the reason for the rise of the water rocket and the reason for falling to the high altitude, and in the knowledge review, not only involves the role of the force learned before is mutual, as well as the first law of Newton, just learned Newton's first law, as well as the pressure and pressure to be learned next, so the "water rocket" fun experiment, the knowledge is widespread, students are interested in the same time, The knowledge contained in it can be understood and applied.			

4. Research Results

This chapter takes "Newton's First Law" as an example, and carries out the teaching design of the delayed service after the second grade physics class, in the whole teaching process, the students' independent learning ability is improved, the group cooperation ability is improved, and they also have a deeper understanding of the classroom knowledge, so that students can better learn physics[7,8.9].

Before and after nearly three months of after-school deferred service in the form of fun experiments, students in four classes of the second grade of a school were surveyed and the results of the survey were analyzed[10].

4.1 Analysis of Students' Learning Interest

The analysis of students' interest in learning is shown in Table 2.

Table 2 Student Questionnaire Survey

(A- likes B- likes C- general D- doesn't like it).

issue	2.15 Survey Results				4.29 Survey Results			
	One	B	C	D	One	B	C	D
1. Are you interested in the discipline of physics?	32%	24%	25%	19%	75%	14%	7%	4%
2. Are you interested in physics experiments?	40%	23%	28%	9%	81%	15%	4%	0%
3. Are you really interested in the presentation in class?	38%	35%	24%	3%	81%	14%	3%	2%
4. Are you interested in doing experiments on your own?	26%	26%	38%	10%	77%	10%	8%	5%
5. Will you understand the principles of fun physics experiments while watching them?	35%	27%	27%	21%	64%	16%	10%	10%
6. Will you take the initiative to go to the teacher to explore the principles of these interesting experiments?	38%	34%	5%	23%	68%	22%	0%	10%
7. Do you think fun physics experiments can increase your interest in learning physics compared to traditional experiments?	70%	20%	4%	6%	89%	5%	5%	1%

From the above data, it can be seen that after the after-class delay service, 81% of students have a great interest in physics experiments, and 77% of students will take the initiative to do experiments after class, compared with only 26% of students who are willing to do experiments after class, which shows that students' interest in physics has been greatly improved; 89% of

students believe that fun experiments can attract their attention more than traditional experiments, which shows that students prefer the teaching mode of fun physics experiments carried out by after-school delayed services[11].

4.2 Analysis of Students' Academic Performance

Select the final grades of a class in a middle school and the results of several examinations in this semester for comparison, and compare the excellent rate and pass rate of the class through a learning performance system, [12] where the excellent rate refers to the proportion of students with more than 85 points, and the pass rate refers to the proportion of students with a score of more than 60 points, and the analysis results are as Table 3 follows[13]:

Table 3 Comparison of Students' Academic Performance

Grade distribution	Last semester's final exam	Results of this mid-term examination (after the fun experiment).
90-100	0	13
80-89	14	16
60-80	27	13
60 points or less	11	10
Average score	67.7	76.0

From the above chart, we can see that after carrying out the after-school delay service centered on fun experiments, the high score rate has increased, the excellent rate has increased by nearly ten percent, and the good rate has also been greatly improved, so it can be preliminarily concluded that the introduction of physical fun experiments in after-class delay service time can improve students' test scores to a certain extent.

4.3 Evaluation of Schools and Parents and Social Impact

As a result of this practice, not only did the students respond well, but the school leadership recognized, appreciated, and promoted these types of activities and supported the physics subject to continue to develop interesting physics after-school activities. Our 8th grade physics group posted beautiful articles that were well received by other schools and students' parents. In our spare time, we posted the wonderful video moments taken during this activity on our WeChat platform, which received hundreds of thousands of plays. According to the comments, it was unanimously approved by many members of the community.

From the results of this paper, it is easy to see that using after-school extended service time to conduct fun physics experiments at the same pace as textbook knowledge is not only beneficial to students' healthy physical and mental development, but also consolidates the knowledge learned in usual physics classes, strengthens the connection between schools and parents, and makes parents more understanding and supportive of school activities.

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