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Investigation and Analysis of the Current Situation of Physics Experiment Teaching in Junior High School

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Abstract: *Physics experiment teaching plays an important role in physics teaching and is an important part of physics teaching. Implementing physics experimental education in middle schools can stimulate students' enthusiasm for learning and improve learning efficiency. By intuitively understanding physical concepts and laws, students can develop their observation and thinking abilities. Therefore, investigating the current situation of physics experimental teaching in middle schools is of great significance. Based on the partial research results of middle school physics experiments, investigate the problems that exist in middle school physics experiments. This article mainly analyzes the problems and reasons of physics experimental education.*

Keywords: *junior high school physics, experimental teaching, current situation, investigation and analysis*

1. Introduction

1.1 Research Background

In recent years, with the advancement of the new curriculum reform, physics experimental teaching in middle schools has made significant progress. However, the relatively weak link in middle school physics teaching is still physics experimental teaching, and there is still a gap between the current situation of physics experimental teaching and the requirements of the original physics curriculum standards. In the context of exam oriented education in China, most schools have teachers teaching experiments and students memorizing them. In junior high school physics experimental teaching, the teaching method adopted by teachers is basically to play experimental videos or oral explanations during class to allow students to understand and memorize after class, which leads to students not having the opportunity to do experiments themselves. The only purpose for students to study physics is to achieve exam results. However, interesting physics experiments cannot appear in students' classrooms, and some are just rote memorization, which makes students lack the logical thinking and scientific exploration ability to understand the essence of physics.

1.2 Current Status of Research

Physical experiments are the foundation and important research methods of physics, and are increasingly valued in physics teaching. [1] Physics experiment teaching refers to the practical activity where teachers and students use relevant instruments and equipment to control or simulate physical phenomena, reduce the influence of secondary and unrelated factors, highlight the main factors, and explore the natural laws of things' development in the most favorable situation according to the teaching purpose.

Through literature review, it has been found that many Western countries have long attached great importance to physics experimental teaching. For example, the United States has repeatedly emphasized experiential learning in the context of the new curriculum standards. [3] Teachers are required to use experimental explanations as much as possible instead of language explanations, and encourage students to observe, think, and experiment. In such a class, experiments are often conducted first, and sometimes even most of the time is spent doing experiments; In Germany, teachers have also attached great importance to physics experiments over the years, and there is a saying circulating in the physics teaching community: "It is unimaginable for a physics class to have no demonstration experiments." [5] Generally, the number of physics experiments per class reaches 2 to 3. Foreign physics teachers often cite physical phenomena from daily life and ask students to make their own equipment to carry out abstract concept

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teaching, allowing students to learn knowledge during the experimental process. [6] From their emphasis on the construction of physics laboratories, it can be seen that they attach great importance to physics experiments. [7] As Alan Colburn once mentioned, effective teaching of physics experiments is crucial for laboratory construction and development, and an important way to accurately describe science is through conducting physics experiments. Western countries have a clear understanding of the position of physics experiments in teaching and have implemented some measures to ensure the important position of physics experiments. [9] Due to the different cultural backgrounds of each country, the specific situation of conducting physics teaching varies. The effective measures taken by Western countries in physics experimental teaching may not be fully applicable to China. Therefore, it is necessary to investigate and study the current situation of physics experimental teaching in junior high schools in China.

For relevant research in China, the 2011 edition of the "Physics Curriculum Standards" mentioned that in addition to explaining scientific knowledge and forging students' skills, physics courses also need to cultivate students' learning interest, exploration ability, innovation awareness, scientific attitude, and scientific spirit. Emphasizing the fundamental position of experiments in middle school physics teaching, the following requirements are put forward for the development of experimental teaching: allowing students to participate in the process of experimental exploration, learning physics knowledge, and also learning scientific exploration methods, cultivating students' hands-on practical ability and collaborative innovation spirit.

With the increasing demand of society for talent cultivation standards, physics teaching is increasingly emphasizing the role and value of experiments, and related theoretical research is springing up like mushrooms after rain. Some researchers have conducted relevant research on the specific current situation of physics experimental teaching in rural areas or certain regions in China. For example, Sun Tianlin conducted a survey on the current situation of physics experimental teaching in Nanyang City in his master's thesis "Investigation on the Current Situation of Physics Experimental Teaching in Nanyang City". He mainly analyzed the current situation of experimental equipment, teachers' specific modes in the experimental teaching process, and students' feedback on physics experimental teaching. He also analyzed the impact of experimental hardware conditions on experimental teaching, students' evaluation, expectations, and experimental exploration teaching status [11]. The article "Analysis of the Current Situation of Physics Experimental Teaching in Junior High Schools in Changchun City" published by Fan Wenchao in the Journal of Changchun Institute of Education is also limited to conducting relevant research on Changchun City, from the lack of learning and research on the new curriculum standard, the limited ability of teachers themselves to adapt to the requirements of physics experimental teaching under the new curriculum standard, the teaching of physics experiments between teaching years and schools. There are differences between urban and rural areas and the need to improve the level of exploratory experimental teaching. This article briefly analyzes the problems presented in physics experimental teaching in junior high schools in Changchun under the new curriculum standards [12]. There are also articles in newspapers and magazines related to the theoretical research of physics experiment teaching, such as the "Investigation of the Implementation Status and Analysis of Influencing Factors of Physics Experiments in Junior High Schools in Beijing" in the second issue of the "Journal of Capital Normal University (Natural Science Edition)" in 2015. The author of this article conducted a survey and research on the current implementation status and conditions of physics experiment teaching in Beijing, and proposed limitations on class schedule. Seven possible factors that may affect the implementation of experimental teaching, including tight experimental class schedule, requirements for experiments in the exam syllabus, training and assessment of teachers' experimental skills, convenience of using experimental instruments, teachers' understanding of school experimental resources, teachers' confidence in successful experimental operations, equipment, and laboratory limitations, will be investigated. The article mainly starts from the perspectives of curriculum standards, exam syllabus, and teachers, but does not conduct research on the school's training objectives and the hierarchical division of students; Some studies are conducted on the entire high school or a certain module in high school, such as the "Investigation and Analysis of the Current Situation of High School Physics Experimental Teaching under the Background of the New Curriculum Reform" in the 12th issue of "New Curriculum Research" in 2011, which is a survey and analysis of the current situation of high school physics experimental teaching [14]; There are also numerous studies on the current situation of physics experiment teaching in junior high school, such as the "Current Situation and Effective Teaching Strategies of Physics Experiment Teaching in Junior High School" in the 16th issue of "Middle School Physics" in 2014. It analyzes the problems existing in current physics experiment teaching in junior high school, and then discusses several opinions of the author on how to improve the effectiveness of physics experiment teaching in junior high school. [15] In addition, there is also Hu Dekai's master's thesis "Investigation and Research on the Current Situation of Physics Experimental Teaching in Junior High Schools in Linqu

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County", which states that he conducted an investigation and analysis of the physics experimental teaching in junior high schools in Linqu County, mainly from three aspects: the configuration of current physics experimental conditions, the current status of physics experimental teaching, and the evaluation methods of physics experimental teaching, and conducted an investigation and analysis on the current teaching situation and evaluation methods of physics experiments, objectively and in detail explored the main problems in current middle school physics experiment teaching, hoping to improve the current teaching of physics experiments in rural middle schools. [16]

Through reviewing relevant research, we can find that both domestically and internationally recognize the importance of physics experimental teaching. In experimental teaching, students can experience "scientific inquiry" and learn the methods of scientific inquiry.

1.3 Purpose and significance of the study

China's nine-year compulsory education has been fully implemented, and physics textbooks in secondary schools have been significantly adapted. The teaching of physics experiments will also be carried out accordingly. Based on the current situation of physics education, the problems in physics experimental education are mainly reflected in the following aspects: students have clear goals and requirements for experimental education. Students do not like doing this and will also use the laboratory as part of the game. In the experimental classroom, there is no punishment for playing around and taking detours at will. If there is no effect after conducting the experiment, it is not good to say it. Therefore, the most important task currently is to accelerate the reform of physics experimental education. The purpose of this study is to provide assistance to physics experiment professors, and to explain the many problems that physics experiment professors currently face in conjunction with the concept of the new curriculum reform.

The most important aspect of studying physics knowledge and understanding nature is the teaching of physics experiments. However, in practical physics education activities, most knowledge is not combined with research theory and practice, but still taught in traditional ways. At present, many middle school physics experimental education in China is relatively backward, and the quality of physics experimental teaching needs to be improved, which is not conducive to the development of students. It is hoped that through the study of physics experiment teaching in middle schools, teachers' experimental understanding ability and students' scientific literacy can be improved, and the value of physics experiment teaching can be realized.

In order to obtain research results on physics teaching content, relevant literature is searched through CNKI and other online resources to understand domestic and foreign research results, and the literature is classified and analyzed according to the development requirements of the times. Especially for the necessity of reforming the new curriculum, find the entry point, ideology, and system of this research.

2. The Position and Role of Physics Experiments in Junior High School Physics Teaching

2.1 Beneficial for developing student subjectivity

In the process of middle school physics teaching, experimental teaching can implement the unified educational law of teachers leading students as the main body, which is conducive to the development of students' subjectivity. Teachers play a leading role while respecting students' subjectivity, which means that teachers respect students' existing experiences and ways of thinking, guide students to actively transform internal contradictions, scientifically and reasonably create an educational environment suitable for communication, cooperation, and logical thinking activities for students, design various educational and teaching activities that students are willing and actively participate in, and truly make students the main body that promotes their own physical literacy development. Teachers should make improving the quality of physics experiment teaching a tireless task, which is inseparable from the transformation of teachers' and students' perspectives, with students as the main body of learning activities. Teachers should recognize that students are not only the main body in the classroom teaching process, but also the masters of promoting students' own development. The job of a teacher not only includes imparting knowledge and controlling the classroom, but also guiding students to exert their subjectivity and helping them develop habits, attitudes, and abilities for comprehensive learning. Teachers should pay attention to stimulating students' internal learning motivation, promoting students to transform external motivation into internal motivation, and developing the attitude and habit of active learning and willing to learn. Teachers should recognize that students are constantly developing

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individuals, acknowledge their plasticity and potential for development, and encourage them to actively participate in the learning and exploration of physics knowledge and laws.

2.2 Helps to stimulate students' interest in learning

With the deepening of the new physics curriculum reform, middle school physics teachers have become increasingly aware that the key to successful physics teaching lies in whether experimental teaching can be strengthened and broken through. Experimental teaching often relies most on experimental teaching aids. In middle school physics experimental teaching, by improving or innovating the use and demonstration of experimental teaching aids, students will realize that these simple teaching aids are more closely related to life and can easily form an intimate relationship, that is, "physics is a subject close at hand and a practical subject." Improving and innovating middle school physics experimental teaching aids is beneficial for stimulating students' interest in learning.

2.3 Enriching Physics Experiment Course Resources

At present, there are still some weak links in physics teaching in middle schools in China, such as students' observation and analysis abilities not being well trained, the evaluation system of physics subject literacy is not perfect enough, and students have mechanical memory of some knowledge points. These problems are directly related to the unsuccessful implementation of physics experiment teaching. Correctly and effectively conducting physics experiment teaching can bring knowledge and life closer together, better implement the teaching principle of integrating theory and practice, and become a unique curriculum resource for physics teaching. For example, we transform common objects in daily life into physics experimental teaching aids, which not only make experimental teaching aids more practical and alleviate the problem of insufficient teaching aids, but also cultivate students' creativity and hands-on practical abilities. Therefore, physics experimental teaching is a unique resource for physics courses.

2.4 Promoting the Professional Development of Teachers

Teachers have multiple roles in the teaching process. They are knowledge imparters and researchers of educational phenomena. Teachers should be good at discovering and analyzing problems in their educational career, and improve their professional skills and qualities. The development and innovation of physics experimental teaching is the first challenge for teachers to improve their professional level. Teachers should fully consider the organic combination of traditional experimental teaching aids and modern teaching media facilities while meeting the requirements of the textbook. Teachers should not only ensure the organic combination of the two, but also recognize the dominant position of students in the experimental teaching process. They should focus on survival, situational awareness, and student development, truly making the development of students' basic knowledge and abilities the first requirement of teaching, and paying attention to the growth and learning of each student. Promoting the reform and innovation of middle school physics experimental teaching can not only unleash students' subjectivity, but also help teachers learn to reflect and summarize, promote the development of teachers from novice teachers to expert teachers, and improve their ability to organize experimental teaching. Therefore, studying the current situation of physics experimental teaching can make experimental teaching itself a catalyst for cultivating backbone teachers with innovative spirit and high professional skills, which is conducive to promoting the professional development of teachers.

3. Investigation on the Current Situation of Physics Experiment Teaching in Junior High School

3.1 Survey Object

The author has designed the questionnaire for this article by referring to excellent master's thesis, such as Luo Zhengqiong's Research on the Cultivation of Junior High School Students' Physics Experiment Inquiry Ability and Mao Yinqin's Investigation and Research on the Current Situation of Junior High School Physics Experiment Teaching Based on the Cultivation of Scientific Inquiry Literacy. The survey respondents selected some students and some physics teachers from A Middle School. The questionnaire was distributed in mid April 2020, and due to the impact of the epidemic, the questionnaire recovery rate was relatively high. A total of 235 questionnaires were distributed to students, and 233 questionnaires were collected except for invalid ones, with a recovery rate of 99%, which has high reference value. A total of 44 questionnaires were distributed to teachers, with 0 invalid questionnaires

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and a recovery rate of 100%. The proportion of male and female teachers participating in the questionnaire survey is balanced, with each accounting for 50%.

3.2 Investigation Content

3.2.1 Attitude towards Physics Experiment Teaching

According to the questionnaire data, most teachers believe that experimental teaching plays an important role and status. More than half of the teachers believe that experimental teaching is "very important", while a small number indicate that physics experiments are "relatively important", "average", "less important", and "very unimportant" options that no one chooses (see Figure 1). Through one-way ANOVA (using the grade taught by the teacher, the current teaching experience of the teacher, the teacher's professional title, and gender as independent variables, and the teacher's understanding of experimental teaching as the dependent variable), the results showed a significance greater than 0.05, indicating that the difference was extremely low. This indicates that there is no difference in teachers' cognition among these four independent variables.

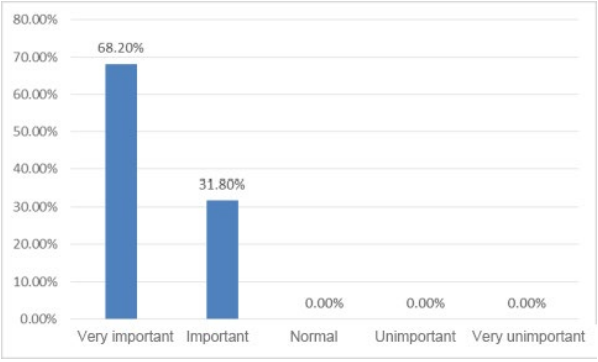

Figure 1: Statistical Results of Teachers' Cognition of the Status of Experimental Teaching in Physics Teaching

In terms of teachers' understanding of the functions possessed by physics experiments, the survey results show that teachers have a consistent understanding of the functions of physics experiment teaching, with a percentage of 100% of cases (see Table 1). It can be concluded that the middle school physics teachers who distributed the questionnaire have a consistent and clear understanding of the functions of physics experiments.

Table 1: Statistical Results of Teachers' Functional Cognition of Physical Experiment Teaching

		response		Case percentage
		Number of cases	percentage	
In your opinion, what are the functions of physics experiment teaching?	Help students understand physical concepts and laws	forty-four	25%	100%
	Cultivate students' interest in physics learning	forty-four	25%	100%
	Train students' physics experimental skills	forty-four	25%	100%
	Assist students in implementing exploratory learning	forty-four	25%	100%
total		one hundred and seventy-six	100%	400%

3.2.2 Purpose of Physics Experiment Teaching

In terms of the cognitive level of teachers and students towards the teaching objectives of physics experiments, the survey results show that there is almost no difference in teachers' understanding of the teaching objectives of middle school physics experiments. The teachers participating in this questionnaire survey all chose the same option (see Table 2). Students' understanding of the purpose of physics experiments varies. Most students believe that the purpose of physics experiments is to impart

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systematic physics knowledge and stimulate interest in physics learning. A small number of students choose physics experiments to improve their ability to solve physics problems, cultivate a rigorous and realistic attitude, and cultivate a tireless spirit of innovation (see Table 3).

Table 2: Statistical Results of Teachers' Cognition of the Purpose of Physics Experiment Teaching

		response		Case percentage
		Number of cases	percentage	
What is the purpose of conducting physics experiment teaching?	In order to impart and consolidate physical knowledge	forty-four	25%	100%
	To enhance students' interest in learning physics	forty-four	25%	100%
	Enable students to master the ability to use experimental methods to solve physical problems	forty-four	25%	100%
	Cultivate students' rigorous and pragmatic attitude and tireless innovative spirit	forty-four	25%	100%
total		one hundred and seventy-six	100%	400%

Table 3: Statistical Results of Students' Cognition of the Purpose of Physics Experiment Teaching

		response		Case percentage
		Number of cases	percentage	
What is the purpose of conducting physics experiment teaching?	In order to impart and consolidate physical knowledge	one hundred and sixty-nine	30.4%	72.5%
	To enhance students' interest in learning physics	one hundred and seventy-three	31.1%	74.2%
	Enable students to master the ability to use experimental methods to solve physical problems	one hundred and twelve	20.1%	48.1%
	Cultivate students' rigorous and pragmatic attitude and innovative spirit of continuous exploration	one hundred and two	18.3%	43.8%
total		five hundred and fifty-six	100%	238.6%

Through a comprehensive analysis of the above data, the following conclusions can be drawn: on the one hand, physics teachers have an objective perspective on analyzing problems, and their understanding of the purpose of middle school physics experimental teaching is relatively consistent and tidy. On the other hand, according to the data from the student questionnaire, the majority of students choose the two options of imparting and consolidating knowledge and increasing interest as the teaching objectives of physics experiments. Therefore, students are more looking forward to the role of physics experiments in imparting knowledge and increasing learning interest. It can be seen that students' understanding of the purpose of physics experiments is relatively one-sided and shallow.

3.2.3 Media for Physics Experiment Teaching

From the survey results of students, it can be seen that the vast majority of teachers often use "blackboards", followed by "physical models", and a few teachers use "multimedia projectors", "flip charts", and "slides" for teaching. The number of people choosing "TV movies" is very small. From this, it can be concluded that the order in which teachers and students choose teaching media facilities in physics classrooms is basically the same.

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Table 4: Statistical Results of Teaching Media Used by Physics Teachers in Physics Experiment Teaching

		response		Case percentage
		Number of cases	percentage	
What teaching media do you often use in physics experiment teaching	blackboard	forty-four	37.3%	100%
	Flipchart	fifteen	12.7%	34.1%
	physical model	thirty-four	28.8%	77.3%
	slide	five	4.2%	11.4%
	multimedia projector	twenty	16.9%	45.5%
total		one hundred and eighteen	100%	400%

Table 5: Statistical Results of Teaching Media Used by Physics Teachers in Physics Experiment Teaching According to Students' Perceptions

		response		Case percentage
		Number of cases	percentage	
What teaching media do your physics teachers often use in physics experiment teaching?	blackboard	two hundred and four	40.7%	87.6%
	Flipchart	thirty-nine	7.8%	16.7%
	physical model	one hundred and twenty-seven	25.3%	54.5%
	slide	fifty-seven	11.4%	24.5%
	multimedia projector	sixty-one	12.2%	26.2%
	TV Movies	thirteen	2.6%	5.6%
total		five hundred and one	100%	400%

Through a comprehensive analysis of the above data, the following conclusions can be drawn: firstly, physics teachers tend to choose traditional media facilities when selecting and using teaching tools and facilities, with the blackboard being the most frequently used and the physical model being the second most frequently used. Due to the relatively low frequency of use of advanced media facilities, this has led to a single choice and use of teaching media facilities, which will have varying degrees of negative impact on the development of physics experimental teaching. Secondly, some modern teaching media facilities are not frequently used, especially those that can be well integrated with physics experimental teaching, such as "multimedia projectors" and "television movies", which have not been widely used. Generally speaking, the teaching media facilities used by physics teachers for teaching still have a certain gap compared to the requirements of modern teaching in this field. The selection of media facilities should be more diverse and flexible.

4. Strategies and Suggestions for Teaching Middle School Physics Experiments

Based on the feedback from the questionnaire, we can recognize that there are still many problems that exist in the current physics experiment teaching, and there are many reasons for these problems. We should analyze and solve these reasons to reform the problematic parts of middle school physics experimental teaching, so that it can fully play its unique role in cultivating students' scientific cognition and other aspects. Therefore, in response to the actual situation of middle school physics experimental teaching, the author proposes the following suggestions:

4.1 Transforming the Concept of Teachers and Students and Strengthening the Teaching of Physics Experiments

4.1.1 Transforming Students' Learning Views and Strengthening Physics Experiment Teaching

In the questionnaire survey, we found that students do not have much importance in physics experimental education. It is also related to the current exam centered education. One exam determines a lifetime, so that students can know how important high scores are. In addition, the proportion of test papers to experimental content is not large, and most of them are theoretical knowledge, making it

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impossible for students to pay attention to experimental education. In order to emphasize experimental teaching, schools, teachers, students, etc. should adopt a correct attitude, reform their thinking, and strengthen the emphasis on experimental teaching. Only in this way can the new teaching curriculum standards meet the basic philosophical conditions of experimental teaching.

Students experience the entire process of scientific exploration, master scientific knowledge, practice operational techniques, stimulate interest in physics learning, and thus better grasp the methods of scientific research. When students conduct experiments, teachers should reasonably guide and pay attention to their experimental assignments, and organize group discussions on the main problems discovered in the experiment, so that students become the main body of learning and can participate in the entire experimental process.

4.1.2 Transforming Teachers' Teaching Views and Strengthening Physics Experiment Teaching

The current problems in junior high school physics experiments are closely related to our educational concepts. The rewards for teachers and students are both tied to grades, and people only care about grades, while good grades are related to tactics. Over the years, high-quality

The development of education has been almost unsuccessful. To adapt to the new curriculum standards and the requirements of high-quality education, it is necessary to change the traditional education concept that the entire society is not adapted to the development of the times. The Ministry of Education and schools should pay attention to physics experimental education. But most school leaders have no sense of experimentation at all, and students are still worried about intentionally damaging laboratory equipment and safety issues. So the laboratory is only used for a period of time in physics experiments. These outdated management ideas and systems seriously affect the development of physics experimental education, and the concept of the new curriculum runs counter to the training objectives of physics experimental education. School leaders should pay attention to physical experiment education. Through interviews and surveys, the author learned that due to the relatively low proportion of experimental teaching by most teachers in intermediate exams, students' internship experiments are not given importance. The result of the time interview is that we know that most teachers ignore the cultivation of students' 'experimental exploration ability' and scientific exploration spirit, and still pursue high scores. Therefore, in order to comprehensively develop and improve students' overall quality, as cutting-edge teachers, we first need to update educational concepts and effectively carry out physics experimental education, improve the quality of experimental education, and make experimental education have unique functions.

4.2 Strengthening the Development of Physical Experiment Curriculum Resources Outside the Laboratory

Physics teachers should fully utilize the existing resources of physics laboratories and actively develop new curriculum resources. In order to keep up with the trend of the times, physics teachers should establish open perspectives on curriculum resources during the development process. Handle problems with an open mindset, observe problems with an open eye, and think about problems with an open mindset. As long as we can improve the quality of physics experimental education and promote the development of student course resources, we can all develop and use them. By practicing, students will leave a deep impression, which has many benefits for cultivating students' knowledge and abilities. Therefore, physics teachers should be adept at using various resources for physics experimental education.

4.3 Developing and Utilizing Various Physical Experiment Course Resources

Since the new curriculum reform, people's focus has shifted from the handling of curriculum resources to the development and application of curriculum resources. Curriculum resources no longer only include paper-based basic education textbooks, but gradually begin to emerge as dynamic basic education curriculum development. According to the definition of curriculum resources that combines the characteristics and situations of physics experiment teaching, physics experiment curriculum resources should refer to the sum of all human, material resources, and various natural resources, meeting the conditions that can be used in unpredictable physics experiment teaching processes. From this, it can be seen that in order to better carry out middle school physics experimental teaching, the standards for the development and application of physics experimental course resources will be increasingly high.

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4.3.1 Make full use of existing laboratory resources

In terms of the actual situation of conducting physics experiments in middle schools, physics laboratory resources are the most noteworthy course resources, and the various experimental equipment provided by the laboratory is an important material guarantee for the effective implementation of physics experiment teaching. With the continuous development of productivity and scientific technology, the cycle of updating scientific knowledge is becoming shorter and the speed of updating physical experimental equipment is also accelerating. However, due to funding shortages and rising prices for experimental teachers, it is almost impossible to completely update experimental equipment. Current physics teachers need to make full use of existing physics laboratory resources. We can consider it from the following perspectives. The physics laboratory can be regularly opened to students, changing the closed state of the physics laboratory, and providing students with rich physics laboratory resources. Physics teachers should encourage students to boldly enter the laboratory, choose appropriate research topics based on their own learning requirements, or carry out individual research or group work. By doing so, we aim to enhance students' experimental abilities, enhance their overall abilities, and maximize the utilization of various resources in the physics laboratory. Maximize the use of all things and one or more, and strive to improve the practical use of laboratory equipment. In the process of physics experimental education, physics teachers fully utilize the functions of a single physics experimental device when conducting experiments on physical equipment, and can achieve a single purpose for various purposes. For example, test tubes commonly used in physics experiments can be used to heat water to display changes in sound tone, or combined with large and small test tubes to display the presence of atmospheric pressure, and can also be used to drive buoyancy floating. While improving equipment utilization, it can bring subtle impacts to students and cultivate their diverse ideas. I believe that by paying more attention to observation and thinking, we will make more discoveries.

4.3.2 Strengthen the development of physical experiment course resources outside the laboratory

Physics teachers should fully utilize the existing resources of physics laboratories and actively develop new curriculum resources. In order to keep up with the trend of the times, physics teachers should establish open perspectives on curriculum resources during the development process. Handle problems with an open mindset, observe problems with an open eye, and think about problems with an open mindset. As long as we can improve the quality of physics experimental education and promote the development of student course resources, we can all develop and use them. You can use regular stationery and daily necessities for experiments. These come from different sources and are easy to obtain. The experimental results are more intuitive, which can stimulate students' attention and cultivate their understanding of experimental technology and innovation. Physics experimental education encourages teachers and students to manufacture experimental equipment for experiments in order to promote the development of students' personalities. The independently produced experimental equipment is an innovative process with very individual results, which can promote individual development of students and also reflect the individual education of physics teachers. For example, when studying experiments that affect buoyancy factors, many schools do not have enough "super heavy pressure cups", but current physics teachers suggest that some students use beverage bottles to make cups using "super heavy pressure cups" before class. The joy of experimentation encourages students to enjoy doing experiments.

4.3.3 Encourage the development and utilization of multimedia teaching resources

The "Curriculum Standards for Compulsory Education" explains the advantages of multimedia teaching resources in the teaching process and the development and application of curriculum resources. At present, the rapid development of modern information technology and the increasing popularity of network technology provide technical support for the development and application of multimedia educational resources. With the help of developed networks and information technology, multimedia educational resources have become more vivid and magnificent. The multimedia teaching resources for physics experiment teaching include various materials related to physics experiments, various computer multimedia software with hypertext linking function, campus LAN, and database resources. In order to cultivate talents who meet the development requirements of the times, while teaching students physics knowledge and showcasing the achievements of modern information technology, in order to cultivate students' lifelong learning awareness, schools and physics teachers should pay more attention to the development and application of multimedia educational resources. For example, in physics experimental teaching, physics teachers should pay attention to the organic combination of traditional teaching media facilities and supporting modern teaching media facilities, learn to use modern teaching media facilities such as computer multimedia software to support experimental teaching, and support students to use the internet to obtain learning materials. Physics teachers can use audiovisual materials to demonstrate to

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students when teaching uncommon problems such as atomic power plants, space launches, and nanotechnology in real life. Physics teachers who teach convex lens imaging principles can simulate experimental results by simply using computer software and dragging the mouse. Due to the surge in popularity of multimedia education resources today, physics teachers should stand at the forefront of the times and make more efforts for physics experimental education.

4.4 Develop and integrate physical experiment resources, improve physical experiment facilities, and achieve perfection

Physics course resources refer to various conditions that are required to achieve course objectives during the teaching process. They are a course resource that covers the design of physics experiment teaching, reflects teaching content and requirements, and cultivates students' hands-on practical abilities. The correct and effective development of course resources can promote the achievement of physics teaching objectives. Therefore, as teachers, they should be good at utilizing and integrating course resources that are conducive to the development of physics experiment teaching activities in daily life. Relevant education departments should also take measures to encourage the development of physics experimental teaching, such as increasing investment in physics experimental education, efficiently utilizing educational funds, improving the efficiency of reimbursement of experimental equipment, and endowing experimental education management with importance. In addition, teachers should also maximize their creativity, creatively use existing experimental tools, develop auxiliary tools, and make their own efforts to improve the condition of experimental education facilities.

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