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# Feasibility Study on Self-development of Physics Teachers' Curriculum Abilities

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**Abstract:** Currently, with the joint efforts of educators and strong support from the whole society, China's basic education has achieved great success in curriculum reform. The basic education curriculum is also constantly being reformed, among which the physics curriculum after curriculum reform has undergone significant reforms in teaching methods, teaching tools, and teaching thinking, which puts forward new requirements for the development of physics teachers' own curriculum abilities. This article is based on my own practice, through visits and investigations, as well as analysis of the changes in physics teaching under the new curriculum concept. It attempts to redefine the self-development of physics teachers' curriculum abilities from the aspects of teachers' own abilities, changes in the examination system, changes in the education system, and changes in the social environment.

**Keywords:** Physics Teacher; Course Ability; Physics Teaching.

## 1. Introduction

### 1.1. Research Background of the Topic

At present, with the joint efforts of educators and strong support from the whole society, China's basic education has achieved great success in curriculum reform. The basic education curriculum is also constantly being reformed, and the change in curriculum concepts has posed new challenges to educators, especially in the development of the physics curriculum nature of the physics discipline, which has undergone significant changes. From the past emphasis on theoretical knowledge as a single subject, to emphasizing that "compulsory education physics curriculum is a natural science curriculum based on experiments, connected with primary school science and high school physics curriculum, and related to chemistry, biology and other courses, with basic and practical characteristics." This requires physics teachers to completely change their original educational ideas and adapt to the new physics teaching concepts under the new curriculum reform.

### 1.2. The Research Significance of the Topic

Physics plays an important role in promoting the development of human civilization. Whether it is the emergence of modern relativity and quantum mechanics, or the development of basic physics in the past, physics plays an important role behind every qualitative leap in human history. In the 21st century, competition among countries has become increasingly fierce, ultimately stemming from the competition of technology. Technology is the primary productive force in today's world, and its development cannot be separated from education. Future teachers must be research-oriented, open-minded, and versatile. Physics is one of the oldest, most fundamental, and widely applied sciences of humanity. Physics plays a fundamental role in most research fields, and the development level of physics is closely related to the curriculum ability of physics teachers. Therefore, after the curriculum reform, physics teachers are required to transform from teachers who only teach students knowledge to research-oriented teachers, in order to meet the country's demand for research-oriented talents in the new form.

### 1.3. Research Methodology for the Project

This paper is based on my own internship teaching, and obtains practical materials through my own insights and visits. Then, through literature review, relevant theoretical issues are sorted and summarized. Finally, combined with current situation analysis, the research theory is proposed.

Literature research method, by consulting relevant papers and literature on CNKI, as well as searching for relevant books and materials in the library, to understand the research results on the curriculum ability of physics teachers, to understand the current research status, and to discuss the research content in combination with the theory of physics curriculum teaching.

The survey method is to investigate the current situation of physics teachers' curriculum ability in the sample areas during the practice, and analyze the current situation of physics teachers' teaching ability under the background of the new curriculum reform. Collect information through classroom practice teaching and home visits to students, and clarify the problems and shortcomings in the new internship curriculum.

## 2. Research Theoretical Basis

### 2.1. Concept Discrimination

#### 2.1.1. Course

The term 'curriculum' first appeared in the Tang and Song dynasties, when Kong Yingda wrote 'The Book of Songs' ▪ Xiaoya ▪ The sentence "Yi Yi sleeps in the temple, and the gentleman makes it" in "Qiao Yan" is annotated as follows: "To maintain the curriculum, the gentleman must supervise it, which is in accordance with the law and the rule of law." In ancient times, Zhu Xi also explained the term curriculum. Although his explanation clearly defined the curriculum, it had a clear meaning, referring to the curriculum and its functions. This only arranges the learning content of the course and does not involve teaching methods. Many famous educators abroad have also defined curriculum, so what exactly is curriculum? So far, the course has been

divided into two parts: static and dynamic. Static courses include various course documents, such as course plans, course standards, textbooks, and various experiences. They are expected and planned before teaching practice, which to some extent refers to the guidelines, blueprints, and materials that guide course activities.

#### 2.1.2. Course Ability

Domestic scholars have mainly formed two types of views on the definition of teachers' curriculum competence. The first type of viewpoint focuses on "curriculum activities" and regards teachers' curriculum ability as a competence, which is reflected in psychological and physiological characteristics. For example, Wu Huiqing and Liu Yingchun believe that a teacher's curriculum ability is "the psychological characteristics exhibited by the teacher in the process of curriculum operation". Liu Yanchao and Yu Haibo further pointed out that teachers' curriculum ability is gradually formed and developed in curriculum activities, and is a comprehensive reflection of their individual psychological and physiological characteristics that directly affect the effectiveness of curriculum activities.

The second perspective starts from the constituent elements of curriculum ability and describes teacher curriculum ability as a combination of multiple elements. For example, Wei Qingyun and Zhang Lixin proposed that teacher curriculum competence refers to the integration of professional character, knowledge reserves, and curriculum skills demonstrated by teachers when participating in curriculum development activities and completing tasks. Wang Yijun believes that curriculum ability is the basic quality required for teachers to complete tasks such as curriculum design, implementation, evaluation, and management.

Although different scholars have different understandings of curriculum competence, their views all emphasize the activity, practicality, and comprehensiveness of curriculum competence. Curriculum ability is not limited to a single dimension, but rather the active performance of teachers in curriculum practice, reflected in the flexibility of curriculum activities, curriculum teaching, and curriculum practice. This active performance stems from the comprehensive role of teachers' knowledge, intention, and action. Therefore, teachers need to pay attention to the cultivation and improvement of their curriculum abilities in daily teaching.

#### 2.1.3. Curriculum Ability of Physics Teachers

The curriculum ability of physics teachers is gradually formed and developed from the practical teaching process, forming the ability with their own teaching characteristics, which directly affects the effectiveness of teaching activities and is a necessary condition for the smooth completion of the teaching process.

The teaching of physics courses is not just about imparting knowledge of concepts, laws, and facts, but also reveals many truths about the fundamental forms of motion in nature. Through the process of establishing a knowledge system, scientific ideas are condensed and refined to promote the continuous progress of science. Physical science is closely related to human activities and has a huge impact on various fields of humanity. Especially, every revolution in physics has epoch-making significance and can be said to have opened a new era for humanity. Physics itself is a harmonious unity of scientific knowledge, scientific processes, and scientific culture, but this does not mean that physics is equivalent to school physics teaching curriculum. This requires teachers to interpret and transform it, teach according to different regions and students, follow the laws of education, unify the internal ideas, knowledge, and processes of physics discipline, rather than treating it as a task-based knowledge professor and imparting knowledge to students through rote learning. This requires teachers to have the ability to teach physics courses, be familiar with the current situation of physics, and be able to grasp the current development of physics in a timely manner. Only in this way can teachers transform physics courses into courses learned by students' experience. This requires teachers to provide training on curriculum skills from a vague perspective.

### 2.2. Curriculum Literacy of Physics Teachers under the New Concept

Education focuses on nurturing, while teaching focuses on learning. Student centered, teacher led, respecting students' personality and emotions. Physics teaching is a highly practical course that not only provides students with the basic theories of physics teaching, but also teaches them practical skills in physics teaching while imparting fundamental theories. Therefore, learning this course should highlight the practical characteristics, focus on the teaching process of practical training, and become a teacher who integrates knowledge disseminators, mind shapers, and intelligent pioneers.

#### 2.2.1. Characteristics of Physics Learning Methods under New Concepts

1. Initiative: Students shift from asking me to learn to wanting me to learn. I want to learn based on students' intrinsic need for learning, which is manifested in their interest in learning; On the other hand, it manifests as a learning responsibility. Only when students take over the responsibility of learning from teachers and actively undertake the mission of learning, can their learning be truly meaningful.

2. Independence: If initiative is manifested as "I want to learn", then independence is manifested as "I can learn". Every student, unless there are special reasons, possesses significant potential and apparent independent needs and independent learning abilities. Their entire journey in school is essentially a process of constantly striving for independence and gradually achieving independence.

3. Uniqueness: Students have unique personalities, and each student's learning style is essentially a reflection of their unique personality.

4. Experiential: The manifestation of emotions and consciousness generated by direct experience and physical activity.

5. Problem oriented: Generating problems through learning, viewing the learning process as a process of discovering, posing, analyzing, and solving problems.

#### 2.2.2. Types of Learning Methods under New Concepts

1. Self directed learning approach

1. Establish a people-oriented ideology

The people-oriented education requires that in the teaching process, it is clear that students are the center of teaching, and the teacher's responsibility is to guide the way and lay the foundation for students' individual and long-term development. In the organization of teaching, the emphasis should be on teachers' "teaching" to students' "learning".

2. Inspire students' intrinsic learning motivation

Motivation is the source of motivation for behavior. In physics teaching, attention should be paid to maintaining and

stimulating learning motivation. The following methods can be used to induce students' motivation in teaching.

1) Enable students to establish lofty aspirations and stimulate their learning motivation.

2) Cognitive reinforcement motivation refers to the process of enhancing meaningful learning.

3) Timely motivation and reinforcement of learning motivation can be achieved through measures such as expectation motivation, praise motivation, feedback motivation, and success motivation.

3. Establish problem scenarios and focus on method guidance

Teachers should grasp the key stages of students' development based on their age characteristics, knowledge background, ability level, and cognitive rules. Based on their cognitive "zone of proximal development", they should create intuitive and vivid problem situations to stimulate students' questions and guide them to explore and discover solutions to problems.

4. Create a self-learning atmosphere

5. Student participation in evaluating learning outcomes

After guidance from teachers or communication with other students, students can identify their own shortcomings in learning methods and gain inspiration from other students' excellent learning methods.

2. cooperative learning

1) Clarify the tasks of collaborative learning

Clarify collaborative learning tasks to give students a sense of direction and responsibility in collaborative learning. The task design of general cooperative learning should follow the principles of moderation, casualization, and openness.

2) Seize the opportunity for collaborative learning

When it is necessary to push students' self-directed learning to a deeper level; When students' thinking is limited and there is an urgent need for mutual inspiration; When there are significant differences in viewpoints among students that require joint exploration; And when learning tasks are heavy and require division of labor and collaboration.

3) Clarify personal responsibility

4) Strengthen guidance for collaborative learning

Teachers should guide students appropriately in interpersonal communication and group cooperation skills.

5) Pay attention to collaborative learning evaluation

After the completion of student cooperative learning, teachers should conduct a comprehensive evaluation of students' cooperative learning based on their own supervision of the cooperative learning process and verbal or written feedback from the cooperative learning group. Enable each group member to deeply understand that the success or failure of the group is closely related to themselves, thereby recognizing the importance of mutual cooperation and common progress.

3. Exploring learning methods

1) Problem stage

2) Planning phase

3) Study phase

4) explanation

Teachers should make clear demands on students during this process, emphasizing respect for facts, following rules, and expressing research results with a pragmatic attitude to ensure the scientific and rigorous interpretation.

5) Reflection stage

This is an essential key link in inquiry based learning activities, promoting students' deep understanding and diverse thinking on issues.

## 2.3. The Educational Philosophy of Physicists

### 2.3.1. Feynman's Physics Thought

Feynman is a highly unique scientist who never takes anyone's words as truth, which means he must rediscover almost all of physics on his own. He pursues his own insights, rather than directly absorbing others' thoughts as his own. He was mainly inspired by a sentence from Dirac: it seems that this requires a completely new idea of physics. Through Feynman's questioning attitude towards physics, we can glimpse his original essence, which is curiosity, rational questioning, independent thinking, betrayal of authority, and criticism of empiricism. In contrast, when Feynman is applying physics knowledge in practice from daily life, our children are struggling in a sea of questions, just to prepare for the high school entrance examination and get into a good high school. When Feynman and his teachers are discussing the deeper connotations of physics knowledge, our children are still spending a whole year preparing for the college entrance examination, and some students even spend years preparing for it.

Feynman may indeed have exceptional intelligence, but looking at physics teaching after excluding intellectual factors, we have also taken many detours. Our physics teaching only focuses on grades without cultivating students' ability to apply knowledge and gain practical experience. The interest in learning physics is very important, and how to cultivate students' interest in learning should be the primary task of physics teachers. Interest comes from life. Learning physics should not be limited to textbook knowledge, but should be understood through life and then applied to it. Physics originates from life and ultimately feeds back into it.

### 2.3.2. Yang Zhenning's Physics Thought

Yang Zhenning believes that "for decades, the Chinese education sector has developed a habit of rote learning, which has resulted in the cultivation of many very hardworking, well-trained, and knowledgeable students. However, these students' knowledge is one-sided and tends to go in a dead direction." Physics cannot be seen as a theoretical system and its deduction, but as a science that should be linked to experiments, phenomena, and reality.

How to change the position of neglecting experiments in physics education, that is, placing experiments based on theory and experiment.

### 2.3.3. Qian Weichang's Physics Thought

Teachers should have their own opinions; they cannot just follow the book and count after finishing it.

# 3. Factors Affecting the Development of Physics Teachers' Curriculum Abilities and Solutions

## 3.1. Influence Factor

### 3.1.1. The Characteristics of the Discipline Itself Constrain it

Physics is a complex and difficult discipline, which is the sum of multiple disciplines, has a large amount of knowledge, covers a wide range, and has many concepts, laws, formulas, and experiments. This is a huge challenge for many students, making them fearful and resistant to learning physics, which increases the difficulty of teaching for teachers.

A survey shows that middle school students find it difficult

to accept the obscure and difficult to understand knowledge of physics, especially for those with poor mathematical foundations. Physics is a sacred book for them, and over time, they gradually give up their interest in physics. In my survey, when students first started learning physics, they initially maintained a strong interest. However, as they delved deeper into the subject, some students found it difficult to keep up with the pace, which seriously undermined their confidence. Over time, students gradually lost interest in learning physics. The remaining students, although persevering, were more willing to study memorization courses than delving into physics knowledge.

I conducted a survey among students of different grades regarding this situation and found that they unanimously believe that learning physics is a "thankless job". Learning other subjects in the same amount of time can significantly improve grades, while studying physics for a long time may not necessarily lead to progress, and may even result in lower grades than those who do not study diligently. At the end of a study period, it will be found that there are very few students who persist in learning physics, and only a few students with excellent academic performance regard physics as the top bonus point for their studies. It is not denied that some students are indeed interested in physics, but as the difficulty of physics knowledge increases, they are invisibly discouraged. Over time, students gradually lose interest in learning physics, leaving only the fear of avoiding it.

### 3.1.2. Differences in School Environment

Although the new curriculum reform has been promoted for some time, some areas have had little effect, especially in underdeveloped rural areas. The proportion of teachers in rural areas who are older is very high, because modern young teachers are willing to teach in cities rather than in difficult conditions in rural areas. At the same time, there are significant differences in the teaching environment, teaching facilities, and urban areas in rural areas, especially for subjects such as physics that require strong practicality. The shortage of experimental equipment severely limits the development of physics teachers' curriculum abilities.

My survey of some towns and urban areas shows that the proportion of physics laboratories in middle schools in urban areas has reached 100%, and the proportion of equipment that meets modern physics experimental standards has also reached over 80%. Only a small proportion of township middle schools have physics laboratories, and the experimental equipment configuration of most middle schools cannot meet the national standards, which cannot meet the diverse requirements of physics experiments under the new curriculum standards. Teachers can only do some demonstration experiments in the classroom during teaching, and some large experimental equipment cannot be effectively matched. Only 7 to 8 people can use one set, which cannot effectively take care of every student after a class, let alone make students practice repeatedly to achieve proficiency standards.

### 3.1.3. The Constraints of Examination System and Social Environment

Influenced by the traditional concept of exam oriented education, the phenomenon of solely relying on scores in primary and secondary school teaching in China is becoming increasingly serious. Under the guidance of the two major exams, the high school entrance examination and the college entrance examination, teachers have become accustomed to the knowledge imparting teaching method, especially in underdeveloped rural areas where scores are even equivalent to students' future. Only by getting high scores can one enter the ideal high school, and only by getting high scores can one go to the ideal university. Therefore, in this environment, teachers no longer pay attention to the development of students' abilities. Especially in physics teaching, memorizing formulas and solving problems has become a winning weapon for teachers to improve their teaching performance. In this mode, physics teachers gradually become teachers who lack teaching ability and rely solely on knowledge.

The new curriculum standards require teachers to not only focus on imparting knowledge, but also on improving students' abilities. However, in the larger environment, it is difficult to make changes. Taking my internship school as an example. During my internship, I found that teachers only focus on one issue in their teaching, which is how to improve students' grades. This leads to teachers neglecting the development of students' abilities in the teaching process, and in the end, they only skim through knowledge without understanding it. In physics teaching, I found that both young and old teachers have not combined the imparting of knowledge with the exercise of experimental skills. During interviews with school teachers, I found the following reasons: firstly, the current teaching assessment focuses more on the mastery of physics knowledge, while there is not much emphasis on practical skills. At the same time, the school curriculum is very tight and there is not much time spent on cultivating students' experimental skills; Another reason is that there is a severe shortage of experimental teaching tools, and some experiments are not sufficient to support the use of all students. Therefore, in order to save time, teachers can only do the process of students' observation a few more times. This leads to many students having high expectations but low skills, and they become useless at first glance.

### 3.1.4. Teacher's Own Factors

1. Teachers who have just graduated and started working lack teaching experience, and some teachers have no teaching experience at all. This requires a long time of experience accumulation, and this process requires students to be the objects of teacher internships, which will have a great impact on teaching effectiveness. New teachers have not developed their own curriculum abilities and only focus on understanding physics as a subject of knowledge, spending most of their time on comprehending and mastering physics knowledge.

2. After the new curriculum reform, physics teaching has moved away from the model of teachers lecturing students and unilaterally imparting knowledge. Teachers are no longer the main body of the teaching process, but have shifted the focus of teaching to students. However, this transformation poses great challenges for teachers. Teachers not only need to change their own teaching mode in the past, but also develop new curriculum abilities to adapt to the new teaching mode under the exchange of teacher and student identities. The new teaching mode requires teachers to break free from the limitations of textbooks, be able to innovate the knowledge they teach, and be able to make choices and additions to textbooks, changing the past approach of completely treating textbooks as authoritative and teaching according to textbooks, without reflecting the characteristics of their own curriculum teaching.

3. With the continuous trend towards modern technology in physics teaching, new requirements have been put forward for

the curriculum ability of physics teachers. During the teaching process, teachers should make good use of modern teaching methods, such as multimedia teaching, micro course teaching, MOOCs and other online resources. However, this also exposes many problems, that is, teachers of different ages who have not received relevant training find it difficult to master these modern technologies. They not only fail to experience the convenience brought by technological teaching, but also become a teaching burden. Some teachers try to read the courseware conveniently and quickly, but only repeat the content of the courseware after a class, without reflecting the characteristics of their own teaching.

## 3.2. Improvement of Curriculum Ability Strategies for Physics Teachers

### 3.2.1. Improvement of Physics Teachers' Personal Literacy

Teachers will make students love themselves and then love this course, which is a common phenomenon in life. In addition to completing their own teaching tasks, teachers should also strive to improve their teaching literacy and enhance their personal charm. Good teachers will make a class come to life and enable students to spend a happy class. In daily teaching, this requires teachers to pay attention to their own dressing. Good dressing will attract students' attention and help teachers guide the direction of a class. Teachers should pay attention to the art of language, organize beautiful and meaningful language, and help students accept and recognize it. The adjustment of tone and stress will enable students to learn in a targeted manner, and students will not be too tired after a class.

Teachers should also enhance their proficiency in using technology teaching tools. Nowadays, using multimedia teaching has gradually become a new teaching mode. A good courseware can add a lot of color to one's class. The success or failure of the introduction at the beginning of the courseware plays an important role in the development of the next class. Successful classroom introduction will immediately attract students' interest and help them enter the state as soon as possible. The addition of some videos in the courseware not only helps students relax their nerves, but also further consolidates their knowledge. Teachers and students' knowledge also cultivate their emotional attitudes. This kind of teaching is economically convenient and can take care of all students.

### 3.2.2. Improve Classroom Teaching Mode and Cultivate Learning Thinking and Hands-On Ability

Under the new curriculum teaching mode, teachers should abandon the original cramming teaching mode and guide students to study independently and cultivate their ability to solve problems independently, which is particularly important in physics teaching. For example, before the start of a class, the teacher should guide students to discover and explore problems first. When students encounter problems that cannot be solved, the teacher should then guide them to discuss and solve them. This can fully stimulate students' enthusiasm and initiative in learning. This also fully embodies the teaching philosophy of teachers leading students as the main body.

Physics teaching should not only teach students knowledge, but also cultivate their hands-on ability. The teaching of knowledge is the condition for students to conduct hands-on experiments, and students' hands-on practical ability is the external manifestation of their mastery of knowledge. The venue for teachers to teach physics knowledge should not be limited solely to within the teacher, but should step out of the classroom and use a combination of teaching and practice to deliver lectures. For example, when teaching Newton's laws, the teacher only uses formula deduction to prove that it is too abstract for students to understand. If students can experience the acceleration effect, force interaction, and inertia firsthand through small games, they will not only learn knowledge but also enhance their application of it.

### 3.2.3. Enhancing Physics Teachers' Ability to Improve Experiments

At present, physics teachers only focus on theoretical knowledge training and neglect the development and training of experimental courses. Most physics experimental teaching now only stays at the interpretation of textbook experimental steps and lacks the ability to flexibly improve experiments, which puts higher demands on school teaching facilities. Satisfying teaching conditions allows for the completion of relevant experiments in physics laboratories, but the current teaching conditions in many schools cannot meet the teaching needs of all experiments, which leads to teachers not paying attention to the teaching of experiments. We can conduct experiments to improve this situation, achieving teaching objectives while also breaking through the limitations of teaching tools.

For example, when exploring atmospheric pressure experiments, we can use other tools instead without relevant experimental equipment. Replace capillary tubes with straws, replace sinks with buckets, and then re measure atmospheric pressure with students during breaks. This can cultivate students' spirit of exploration while also increasing the emotional connection between teachers and students. It can also allow students to personally experience the exploration process, feel the charm of physics, and fall in love with physics.

# 4. Teaching Case Design

Physics teaching adopts the method of learning before teaching and practicing in class. Before each class, students should first self-study, which is divided into three parts: pre class self-study, classroom intensive learning, and post class re learning. Pre class preview requires students to complete it independently and tests their willpower. In practice, this part is not done very well, so classroom intensive learning is the most crucial and exciting part. Each class is assigned learning tasks and content by the teacher, and then students self-study the textbook. Through group discussions, students solve and attempt to solve problems, and then summarize what they know, what their problems are, and what they still want to learn. Pay attention to cultivating students' initiative in learning, and transform their thinking from 'I want to learn' to 'I want to learn'. Teachers should be able to guide students to participate in physics teaching and conduct teaching case studies using buoyancy as a case study.

1. clear learning objectives

Knowing the causes of buoyancy, understanding that all objects are subject to buoyancy, and being able to analyze that the direction of buoyancy is always vertically upward; Can measure the magnitude of buoyancy; Can determine the buoyancy conditions of objects.

2. teaching steps

1) Pre class import

First, let the students learn by themselves before class, study the original textbook, understand the knowledge points

by themselves, solve the problems in the progressiveness group, and summarize the problems that cannot be solved to the teacher. The teacher will carry out teaching according to these contents.

Purpose: To cultivate students' self-learning and cooperative learning abilities, while stimulating their interest in learning, enabling them to more effectively and quickly absorb the knowledge they have learned.

When students preview the content of buoyancy, they should focus on the key and difficult points. The causes of buoyancy can be collected by themselves, displayed and shared in class, which can be pictures or stories, and then organized by the teacher. This can serve as a good classroom introduction part.

2) Classroom teaching activities

(1) Teachers can make students feel buoyancy by preparing two plastic pots of different sizes in advance. The large pot is filled with water, and the small pot is placed in it and pressed by hand to let students feel the direction and size of buoyancy. Then demonstrate the application of buoyancy in daily life to students through multimedia, enhancing their theoretical application ability.

Student activities deepen the understanding of knowledge through practical operations and add a lot of fun to the classroom. When students have solved all the problems and mastered the knowledge, they can further explore.

When exploring the factors that affect buoyancy, teachers can place heavy objects in a small basin and let students observe the depth of the basin's immersion in water as the weight is added, in order to explore the effect of depth on buoyancy; Using a spring load cell and a lightweight aluminum block (the aluminum block should be able to be submerged in water), then a transparent container is filled with a certain amount of water (the depth of the water should ensure that the aluminum block can be submerged, and the water should not be too much, otherwise it is difficult to make a significant change in the density of the water). The aluminum block is hung on the spring load cell and immersed in water to measure the reading, and then salt is added to the container to change the density of the water, in order to explore the effect of density on the buoyancy of objects.

Student Activity: Experiment 1: As the weight of the heavy object increases, the volume of the small basin immersed in water increases. By comparing the changes before and after, it can be concluded that the buoyancy is related to the depth of immersion in the liquid. Experiment 2, first record the initial reading of the spring force gauge, then slowly add salt to the water to increase the liquid density. When the reading of the spring force gauge does not change, record the reading of the spring force gauge at this time. Compare the two readings and find that the latter reading is smaller than the former, indicating that the liquid buoyancy caused by density is greater.

Teaching process evaluation: This method of conducting experiments using existing equipment overcomes the limitations of insufficient experimental instruments and can better lead students to explore physics experimental phenomena, making them feel the magic of physics. Using objects that they can usually see to conduct experiments will be practical and conducive to cultivating students' spirit of exploration, making them feel the charm of physics everywhere.

The buoyancy and buoyancy conditions are the key and difficult points of this lesson. Through group discussions, students who are good at learning can lead students with weak foundations. Finally, the unsolvable problems can be summarized by the teacher, which can effectively save time and better teach key and difficult knowledge.

In this section of teaching, physics teachers can use the form of intra group discussion and inter group competition. The teacher leads the students to familiarize themselves with teaching equipment: plastic bottle caps, small iron blocks. Experimental steps: First, place the bottle cap and observe it floating on the water surface. Then gradually add the patch until it is completely submerged in the water. The bottle cap and the small iron piece float together in the water. Continuing to add the iron piece will result in both sinking to the bottom of the water. At the end of the student experiment, analyze the force process based on the experimental phenomena, and present the force analysis diagram to each group on the podium. Provide targeted explanations based on the problems reflected by each group. Finally, the teacher summarized that the condition for an object to float is that the buoyancy it receives is greater than its own mass; Condition for object buoyancy: The buoyancy force exerted on an object is equal to its own mass; Condition for object sinking: The buoyancy exerted on the object is less than its own mass.

Teaching process evaluation: Forming assistance within the group and competition between groups, supplemented by reward measures, can effectively mobilize students' learning enthusiasm and initiative, and cultivate their ability to cooperate and explore. Encouraging students to demonstrate on the podium and participate in teaching activities can enhance their confidence and experiential experience. Throughout the process, students will constantly engage in self reflection and serious thinking, which will make their knowledge mastery more solid.

# 5. Research Conclusion and Prospect

## 5.1. Research Summary

This study discusses the feasibility of developing the curriculum abilities of physics teachers. The curriculum development of physics teachers should focus on cultivating their own qualities while forming a student-centered teaching philosophy. This article discusses the development of physics teachers through theory and proves the feasibility of implementing this theory through teaching cases.

## 5.2. Prospect

Physics is the most important fundamental subject, and physics teachers, as disseminators of physics knowledge, should shoulder the responsibility of cultivating innovative talents for the country. This requires physics teachers to transform their teaching ideas, especially middle school teachers. Middle school physics teachers are the most important guides for students to learn physics, playing a key role in making students fall in love with physics and inspiring their interest in learning physics. So, physics teachers

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