

# *An Effective Strategy of High School Physics Teaching Reform under the Background of New College Entrance Examination*

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**Keywords:** High School Physics, Physics Education, Teaching Reform

**Abstract:** High school physics education is undergoing significant reforms and challenges in the context of the new college entrance examination (gaokao). The new examination system requires students not only to master rich knowledge but also to cultivate practical application abilities, interdisciplinary thinking, and comprehensive qualities. However, traditional physics teaching methods and assessment approaches often have limitations and fail to fully meet the requirements of the new college entrance examination. In this context, the reform of high school physics education becomes urgent. This paper explores effective strategies for the reform of high school physics teaching.

## 1. Introduction

The importance of high school physics education cannot be overlooked. It not only provides students with key knowledge to understand the natural world but also cultivates analytical and problem-solving abilities, laying a solid foundation for future career and learning development. However, under the backdrop of the new college entrance examination, high school physics education is facing unprecedented challenges. With the reform of the college entrance examination system, educational requirements are gradually moving towards a more comprehensive, practical, and interdisciplinary direction. Traditional physics teaching methods and assessment approaches often fail to adapt to this transformation, making it an urgent task to better teach and assess high school physics.

## 2. Key Points of High School Physics Teaching Reform under the New College Entrance Examination (Gaokao) System

### 2.1. Clarifying Reform Focus

In the new college entrance examination system, the key points of high school physics teaching reform should involve a redefinition of educational objectives. Education goals should no longer be limited to knowledge transmission but should emphasize the development of students' comprehensive qualities and practical application abilities. This implies a focus on interdisciplinary education, integrating physics education with other disciplines to encourage interdisciplinary learning and cultivate students' comprehensive thinking and problem-solving skills. The reform should also

advocate lifelong learning, encouraging students to proactively engage in learning and develop habits of lifelong learning to adapt to the continuously changing societal and professional demands.

## **2.2. Establishing a Comprehensive Knowledge System**

To achieve the new educational objectives, high school physics teaching needs to establish a more comprehensive knowledge system. This includes updating textbooks and curricula to reflect the latest scientific research and technological developments, with a focus on cutting-edge areas and practical applications. Additionally, educational institutions should introduce integrated knowledge, emphasizing the intersection of physics with other scientific fields such as physics and mathematics, physics and engineering, to help students build a more comprehensive knowledge background. Equally important is encouraging students to explore knowledge actively, fostering their scientific curiosity, and guiding them to participate in scientific research and experiments rather than passively receiving knowledge.[1-2]

## **2.3. Cultivating Students' Practical Abilities**

Another focus of high school physics teaching under the new college entrance examination system is cultivating students' practical abilities. This can be achieved by emphasizing practical education, including providing more opportunities for experiments and real-world application projects to enhance students' practical operation and problem-solving skills. Moreover, schools should encourage students to develop innovative thinking, cultivating their problem-solving and creative thinking to address future challenges. Introducing modern technological tools and techniques, such as computer simulations and experimental equipment, can help students better understand and apply physics knowledge, enhancing their technological literacy.

## **3. Principles of High School Physics Teaching Reform under the New College Entrance Examination Background**

### **3.1. Adaptability Principle**

The reformed education system should be flexible to adapt to the continuous changes in the college entrance examination system. Educational institutions need to quickly adapt to new educational requirements, including updating teaching plans, adjusting assessment methods, and implementing new educational policies. Regular evaluation and the formulation of contingency plans contribute to ensuring that education quality remains unaffected.[3]

### **3.2. Comprehensiveness Principle**

High school physics teaching should emphasize comprehensiveness, encouraging interdisciplinary learning by combining physics knowledge with mathematics, chemistry, biology, and other subjects. This helps students to understand and apply knowledge more comprehensively. Project-based learning can also be introduced to encourage students to collaborate on solving interdisciplinary practical problems.

### **3.3. Practicality Principle**

Experiments and real-world applications should hold a significant place in high school physics teaching to cultivate students' practical operational skills. Students should have opportunities to conduct laboratory experiments, modeling, simulations, and real-world application projects to

enhance their problem-solving abilities. Research-based learning is also a method to encourage students to undertake small research projects to explore physics phenomena in-depth.

### **3.4. Independent Learning Principle**

Students should be encouraged to engage in independent learning, fostering their self-management and learning motivation. While schools can provide learning resources, guidance, and feedback, students should take on more responsibility during the learning process. Additionally, schools should encourage students to think independently and solve problems, cultivating their critical thinking and creative thinking to adapt to future challenges.[4]

## **4. Challenges in High School Physics Teaching**

### **4.1. Insufficient Practical Skills**

Many students lack hands-on experience due to the traditional emphasis on theoretical knowledge in physics education. Students often passively receive information without actively participating in scientific experiments or applications. This results in a struggle when facing practical problem-solving, engaging in scientific research, or dealing with everyday physical phenomena. While students may understand the theoretical concepts, they often lack the skills to apply these concepts to real-life situations.

### **4.2. Lack of Student Interest**

Students generally find physics uninteresting, perceiving it as a difficult and frustrating subject. Traditional teaching methods tend to be overly theoretical and abstract, making it challenging to ignite students' interest. The abstract and mathematical nature of physics might discourage students, leading them to choose other subjects that they find easier to comprehend and more engaging. Lack of interest hampers students' motivation and academic performance in physics.

### **4.3. Lack of Innovative Teaching Methods**

Some schools and teachers still adhere to traditional teaching methods, lacking interactive, practical, and interdisciplinary approaches. This may be due to insufficient teacher training, resources, or constraints imposed by curriculum and examination requirements. Traditional lecture-style teaching can be monotonous, failing to spark students' interest or cultivate practical application skills and innovative thinking.

### **4.4. Limitations in Assessment Methods**

Traditional physics exams often emphasize memorization of theoretical knowledge, focusing on students' proficiency in recalling physics concepts, formulas, and theories. This assessment method primarily measures the memorization of textbook content and tends to neglect students' practical application abilities. Traditional exams may not adequately evaluate students' performance in experiments, practical problem-solving, and application projects, failing to reflect their overall qualities, such as comprehensive thinking, problem-solving skills, innovation, and practical operation skills.

## **5. Methods for High School Physics Teaching Reform under the New College Entrance Examination Background**

### **5.1. Diverse Teaching Approaches**

By employing diverse teaching methods, students can learn physics concepts in a more interactive and autonomous manner. Tailoring learning to individual needs and interests helps students grasp concepts better, enhancing their interest in the subject and improving academic performance.

### **5.2. Experimental Teaching**

Introducing innovative experimental teaching strategies enables students to gain a deeper understanding of the relationships between physical phenomena. This approach fosters practical skills and scientific inquiry, making physics learning more attractive and applicable, ultimately increasing students' motivation and interest in studying physics.[5]

### **5.3. Independent Inquiry**

Through independent inquiry projects, students not only deepen their understanding of physics concepts but also develop critical thinking and experimental design skills. This approach makes physics learning more exploratory and practical, improving the effectiveness of student learning.

### **5.4. Project-Based Learning**

Project-based learning allows students to better understand the connection between physics phenomena and laws, enhancing the effectiveness of physics teaching. This method also cultivates practical application skills and innovative thinking, making physics learning more practical and comprehensive.

### **5.5. Interdisciplinary Education**

Introducing interdisciplinary projects enriches students' physics learning experience, fostering comprehensive thinking, problem-solving, and practical application skills. This educational approach enables students to better understand physics concepts, apply knowledge to real-world problems, and lays a solid foundation for future career and academic success.

For example, when studying "circular motion," a project could involve a comprehensive study of circular motion with collaboration across physics, mathematics, and engineering disciplines. The aim is for students to apply their knowledge of circular motion principles and work together to design and construct a practical device that demonstrates circular motion concepts. The project involves learning theory, problem-solving, practical application, and interdisciplinary collaboration. Through such projects, students not only apply physics knowledge to real-world problem-solving but also understand the mathematical principles related to physical phenomena, fostering comprehensive thinking, interdisciplinary collaboration, and problem-solving skills. Teachers can encourage students to undertake broader projects, such as designing other mechanical systems, exploring various applications of circular motion, or using mathematical modeling to solve real engineering problems.

## **6. Conclusion**

The reform of physics education in senior high school is urgent to meet the needs of the new background of the national college entrance examination. By adopting various teaching methods,

experimental teaching, independent inquiry and other strategies, it can better cultivate students' practical ability, stimulate their interest in subjects, and help them cultivate their comprehensive quality. This will make students better prepared to face future challenges and lay a solid foundation for their academic and career development.

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