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Exploration of the Cultivation of Students' Self-learning Abilities through Physics Experiment Teaching

Chao Zhang

School of physics and electronic engineering, Taishan University, 271000, Taian, China

Abstract

In traditional physics experiment teaching, students passively accept knowledge and guidance, and lack the spirit of independent learning and inquiry. The purpose of this paper is to explore the effect of physics experiment teaching on the cultivation of students' self-study ability, from the aspects of teaching methods, learning environment and students' characteristics, so as to provide effective strategies and methods for improving students' self-study ability. Through field investigation and theoretical analysis, this paper draws some conclusions and suggestions, aiming at providing effective strategies and methods for educational practice, promoting students' all-round development and lifelong learning ability, and contributing to improving the effect of physics experiment teaching and students' learning outcomes.

Keywords

Physics experiment teaching, self-learning abilities, teaching methods, learning environment, student characteristics.

1. Introduction

Physics experiments, as an important part of physics learning, not only have intuitive, concrete, and practical characteristics that help students understand and consolidate theoretical knowledge but also cultivate students' skills in observation, experimental design, data processing, and interpretation, as well as a spirit of scientific inquiry. However, traditional physics experiment teaching often revolves around the teacher, with students primarily playing a passive role of receiving knowledge and guidance during experiments, lacking autonomous learning and inquiry spirit. In the current era of information technology and self-directed learning, cultivating students' self-learning abilities is particularly crucial. This paper aims to explore the role of physics experiment teaching in cultivating students' self-learning abilities, conducting research from the perspectives of teaching methods, learning environment, and student characteristics to analyze how physics experiment teaching can promote students' independent learning and critical thinking abilities, achieving better teaching effectiveness and learning outcomes. By discussing the cultivation of students' self-learning abilities, the paper aims to provide effective strategies and methods for educational practice, promoting students' comprehensive development and lifelong learning capabilities.

2. Physics Experiment Teaching as an Effective Approach to Cultivate Students' Self-learning Abilities

Students' self-learning abilities refer to their capacity to independently engage in learning and exploration, including aspects such as autonomous learning, self-management, self-evaluation, and self-decision-making. Possessing good self-learning abilities enables students to better adapt to the explosive growth of knowledge and societal changes, achieving self-improvement and lifelong learning. Therefore, cultivating students' self-learning abilities through physics experiment teaching holds significant practical significance and educational value.

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Physics experiment teaching serves as an effective approach to cultivate students' self-learning abilities. By participating in practical operations, autonomously designing experimental plans, independently solving problems, and engaging in scientific inquiry processes, students not only accumulate experimental experience and skills but also develop observation skills, experimental design abilities, and data processing skills. This practical learning method sparks students' interest and curiosity in the field of physics, enhancing their learning motivation and sense of achievement. Simultaneously, through autonomous learning and inquiry, students gradually cultivate independent thinking, problem-solving, and innovation capabilities, laying a solid foundation for their future lifelong learning and personal development. Thus, physics experiment teaching not only aids students in mastering physics knowledge and skills but more importantly, through experimental teaching, it cultivates students' self-learning abilities, transforming them into learners with lifelong learning capabilities and self-development potential.

3. Existing Issues in Physics Experiment Teaching in Current Physics Experiment Teaching

Some issues lead to students lacking autonomous learning awareness, superficial understanding of experimental content, and a lack of critical thinking abilities. These problems include excessively detailed experiment instructions limiting students' exploration space, direct presentation of experimental results reducing students' opportunities for reflection, and a lack of guidance for students to analyze results and contemplate experimental principles. Taking the example of the grating spectrum experiment in university physics illustrates these issues.

The grating spectrum experiment is a common university physics experiment that utilizes the diffraction phenomenon of light. Students observe the spectrum formed on the grating by light of different wavelengths, exploring the wave properties of light and spectral analysis methods. In this experiment, students need to prepare a light source, a grating, and a spectrometer. They position the light source correctly, allowing light to pass through the grating, and then observe the spectral fringes formed on the grating through the spectrometer. During the experiment, students can adjust parameters such as the light source's position and the grating's tilt angle to alter the observed spectral effects, thereby gaining a deeper understanding of the diffraction phenomenon of light and the characteristics of light of different wavelengths. However, existing issues in physics experiment teaching include:

3.1 Some experiment manuals often provide detailed operational steps and expected results, depriving students of the opportunity to autonomously design experimental plans and explore. Students merely follow the experiment steps without engaging in deep thinking and discussion.

3.2 In the grating spectrum experiment, spectral results typically directly appear on the instrument, requiring students only to observe and record, lacking the process of analyzing experimental data and contemplating experimental principles. This direct presentation of results reduces students' opportunities for reflection and inquiry, affecting their in-depth understanding of the experimental content.

3.3 After the experiment, there is a lack of segments for result analysis, discussion, and contemplation, leaving students unable to grasp the physics principles and significance behind the experimental phenomena, thus failing to cultivate critical thinking and analytical skills.

In conclusion, existing issues in physics experiment teaching include excessively detailed experiment instructions, direct presentation of experimental results, and a lack of guidance for students to analyze results and contemplate experimental principles. To address these issues, teachers can simplify experiment instructions, guide students in autonomously designing experimental plans, encourage students to actively analyze experimental data and contemplate

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experimental principles, thus fostering their critical thinking and analytical skills. By improving the methods and approaches of physics experiment teaching, teachers can better promote students' autonomous learning awareness, deeper understanding of experimental content, and cultivation of critical thinking abilities.

4. The Cultivation of Students' Self-learning Ability through Exploratory Physics Experiment Teaching

The cultivation of students' self-learning ability through exploratory physics experiment teaching is profound and important. Firstly, by designing experiment tasks and projects suitable for students' independent learning, exploratory physics experiment teaching stimulates students' initiative and interest in learning. In such a learning environment, students are no longer passive recipients of knowledge, but actively participate in the process of experiment design, data analysis, and conclusion inference. They need to think critically, solve challenges, and as a result, enhance their problem-solving skills and innovative thinking. In this process, students' self-learning ability is greatly cultivated and improved.

Secondly, exploratory physics experiment teaching provides a learning environment and resource support, creating conditions for students' independent learning. Students can make full use of various experimental equipment and materials in the laboratory for independent exploration and practice. The guidance and support of teachers and lab assistants also play a crucial role in helping students overcome difficulties and solve problems. With such support, students can better demonstrate their independence and creativity, cultivating their self-learning ability and motivation.

Lastly, exploratory physics experiment teaching guides students to engage in critical thinking and exploration, further cultivating their problem-solving skills and innovative thinking. During the experiment process, students need to analyze data, summarize patterns, and discover problems and challenges. Through critical thinking and exploration, students not only acquire physics knowledge but also develop problem-solving abilities and methods. They learn to question, think independently, cultivate critical thinking and innovation awareness, thereby demonstrating stronger self-learning ability in both their studies and daily lives.

In conclusion, the cultivation of students' self-learning ability through exploratory physics experiment teaching is comprehensive. By designing tasks and projects suitable for students, providing support and resources, and guiding critical thinking and exploration, students are able to develop their self-learning ability comprehensively through experiments. This cultivation is not only beneficial for students to achieve outstanding results in physics learning but also influences their lifelong learning and development, equipping them with stronger problem-solving, innovative, and independent thinking abilities. Therefore, promoting exploratory physics experiment teaching will help students become lifelong learners with self-learning ability, laying a solid foundation for their future development.

5. Summary

This paper explores the cultivation of students' self-learning ability through physics experiment teaching and identifies effective teaching methods and strategies that can enhance students' independent learning ability and thinking ability. In the future, further research on the cultivation of students' self-learning ability in the field of physics education can be deepened, continuously exploring and innovating teaching methods, and promoting students' comprehensive development and learning outcomes.

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