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Practice Research on Intelligent Self-driven Learning Guided by Core Competencies of High School Students' Physics in the "Cloud Era"

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Abstract: This study aims to explore the practical application and effectiveness evaluation of an intelligent self-driven learning model guided by the core competencies of high school students' physics in the context of the "cloud era." Through comprehensive analysis of theory and policy, a student-centered, technology-supported intelligent self-driven learning framework was constructed to deepen classroom teaching reforms, enhance students' core competencies in physics, and serve the comprehensive development of students under the new college entrance examination system. Action research, literature research, and case study methods were employed in this study, and a wide range of empirical data was collected through questionnaire surveys, interviews, observations, and experiments. The results show that the intelligent self-driven learning model can significantly improve students' core competencies in physics, promote the development of their innovation ability and autonomous learning ability, and also provide new exploration paths for teachers' educational and teaching methods.

1. Introduction

With the rapid development of information technology and the deepening of global education reform, the advent of the "cloud era" has provided new development opportunities for education. Especially in the field of physics education, how to use modern information technology to improve teaching effectiveness and cultivate students' core competencies has become an important topic in current educational reform. This study focuses on the core competencies of high school students in physics and explores the practical path of intelligent self-driven learning, aiming to stimulate students' internal driving force for learning through technological means, improve their core competencies in physics, and lay a foundation for the cultivation of innovative talents.

2. Theoretical Basis and Policy Foundations

2.1. Conceptual Analysis of Core Competencies in Physics Education

Core competencies in physics education reflect the comprehensive embodiment of key knowledge, skills, and values that students should acquire during the process of learning physics. It encompasses students' ability to effectively analyze, investigate, and solve problems using physics principles and methods when facing real-world physical phenomena[1]. The introduction of this concept aims to guide physics education from mere knowledge transmission towards competency development, placing more emphasis on students' understanding, application, and innovation of physics knowledge. The cultivation of core competencies involves not only the learning of physics knowledge but also the development of scientific inquiry methods, innovative thinking, critical thinking, as well as the formation of scientific attitudes and ethical responsibilities. By fostering students' core competencies in physics education, the goal is to enable students to better adapt to the needs of future society and become citizens with innovative abilities and a sense of responsibility.

2.2. Psychological Foundation of Intelligent Self-Driven Learning

Intelligent self-driven learning focuses on stimulating and utilizing students' intrinsic motivation for learning, with its psychological foundation mainly derived from self-determination theory. This theory posits that human behavior is driven by the satisfaction of intrinsic needs, including the pursuit of autonomy (freedom of choice), competence (efficacy), and relatedness (social connections). In educational practice, intelligent self-driven learning meets these three basic psychological needs of students by providing personalized learning paths, opportunities for autonomous exploration, and platforms for social interaction. For example, utilizing artificial intelligence technology to provide personalized learning resources and feedback can enhance students' sense of competence. Through online collaboration platforms and discussion forums, students' sense of belonging can be strengthened, while open course design and learning choices meet students' need for autonomy. This learning approach emphasizes active student participation, exploration, and collaboration, which are conducive to developing students' autonomous learning abilities, innovative thinking, and teamwork skills[2].

2.3. Analysis of Educational Policies and Teaching Reform Background

Current educational policies and trends in teaching reform clearly lean towards strengthening the cultivation of students' core competencies, especially in STEM education fields such as physics. The driving force behind this is the new challenges and opportunities brought about by globalization and informatization, as well as the increasing demand for innovative talents. Educational policy documents, such as "China's Students' Development of Core Competencies" and "Opinions of the Central Committee of the Communist Party of China and the State Council on Deepening Education and Teaching Reform and Improving the Quality of Compulsory Education," emphasize student-centered teaching philosophies, advocating for teachers to stimulate students' interest in learning and intrinsic motivation through innovative teaching methods such as project-based learning and inquiry-based learning. These policies and reform measures require the education system to integrate resources and utilize information technologies such as the internet, big data, and artificial intelligence to create an environment conducive to personalized learning and development for students, thereby improving the quality of education and cultivating innovative talents adapted to the needs of 21st-century society. Additionally, the "Opinions on Further Reducing the Academic Burden and Extracurricular Training Burden on Students in Compulsory Education Stages" reflect concerns about students' physical and mental health and comprehensive development, emphasizing the reduction of exam-oriented education pressure and placing more emphasis on cultivating students' interests, exercising critical thinking, and enhancing innovative capabilities. These policies and guidelines collectively construct a supportive framework that encourages educators to explore more effective teaching methods and learning models to adapt to the constantly changing social and economic demands.

In this context, the advancement of educational technology provides new avenues for achieving these educational goals. In particular, the development of modern information technologies such as cloud computing, big data, and artificial intelligence provides powerful tools for personalized learning, intelligent teaching, and learning assessment, enabling educational content and teaching methods to more flexibly and accurately meet the learning needs and developmental stages of each student. This technology-driven transformation of teaching models is not only a challenge to traditional educational models but also a tremendous opportunity for improving educational equity and quality.

Therefore, the core of current educational policies and teaching reform lies in how to effectively integrate educational resources, utilize advanced educational technologies, and build an educational ecosystem that can both stimulate students' intrinsic learning motivation and comprehensively enhance students' core competencies. This requires close cooperation among educators, policy makers, technology developers, and various sectors of society to jointly promote the modernization of education and contribute to the cultivation of innovative talents for the new era.

3. Research Design and Implementation

3.1. Research Objectives and Research Questions

This study aims to explore the implementation effects of an intelligent self-driven learning model based on the core competencies of physics education for high school students in the "cloud era" and its impact on enhancing students' core competencies in physics. The specific research objectives include: (1) revealing the internal mechanisms of intelligent self-driven learning on the core competencies of physics education for high school students; (2) exploring effective strategies for promoting the cultivation of core competencies in physics education using intelligent technology in the context of the "cloud era"; (3) designing and implementing a series of intelligent self-driven learning activities based on the core competencies of physics education, and assessing their effects on students' interest in physics learning, autonomous learning ability, and innovative thinking skills[3].

To achieve these objectives, this study will address the following key research questions: (1) What is the current application status of intelligent self-driven learning in physics education and what are the existing issues? (2) What factors will affect the effective implementation of the intelligent self-driven learning model in physics education? (3) What significant impacts does the adoption of the intelligent self-driven learning model have on the cultivation of core competencies in physics for high school students?

3.2. Research Methods and Data Collection

In this study, a mixed research method is adopted to fully understand the application effects of intelligent self-driven learning in high school physics education and its impact on students' core competencies in physics. By combining quantitative and qualitative research, we aim to comprehensively evaluate the effectiveness of the intelligent self-driven learning model from different dimensions and how it affects students' learning attitudes, cognitive processes, and learning outcomes.

In the quantitative research part, we collect a large amount of data through the design and distribution of questionnaires to quantitatively evaluate the impact of intelligent self-driven learning on students' core competencies in physics education. The questionnaire design covers multiple dimensions, including students' interest in physics, self-assessment of autonomous learning ability, frequency of using intelligent learning tools, and perception of their learning outcomes. These data enable us to utilize statistical analysis methods such as descriptive statistics, correlation analysis, and regression analysis to reveal the relationship between the intelligent self-driven learning model and students' core competencies in physics.

In the qualitative research part, we conduct in-depth exploration of the implementation process of intelligent self-driven learning through methods such as interviews, observations, and case studies. Through interviews with teachers and students, we understand the challenges and strategies teachers face in implementing intelligent self-driven learning, as well as students' acceptance, feelings, and feedback on this new learning mode. Observations and case studies allow us to visually see the application scenarios of intelligent self-driven learning in actual teaching, including how teachers use technological tools to promote classroom interaction and how students explore knowledge and enhance their abilities through this learning model.

Data collection revolves around several key aspects: firstly, students' learning motivation and autonomous learning ability are critical to the success of intelligent self-driven learning, and we particularly focus on changes in students' interest in physics and how their ability to autonomously seek knowledge is enhanced during the learning process. Secondly, the role of teachers is crucial in intelligent self-driven learning, and we explore teachers' cognition, attitudes towards this new learning model, as well as the challenges they encounter and strategies they adopt in actual teaching. Finally, a supportive learning environment is the foundation for effective learning, so we also assess the degree of support provided by schools in terms of technological infrastructure, teaching resources, and relevant policies for the implementation of intelligent self-driven learning.

Through the mixed methods research described above, we expect to comprehensively understand the implementation effects of intelligent self-driven learning in high school physics education and how it promotes the enhancement of students' core competencies in physics, thereby providing empirical basis and strategic suggestions for future educational practice and research.

3.3. Research Implementation Steps

3.3.1. Literature Review

Before conducting the research, a comprehensive literature review needs to be carried out. By reading relevant literature, including research results on high school physics education and intelligent self-driven learning in the "cloud era," as well as the latest developments in other related fields, we can gain insight into the current research status and identify shortcomings in previous research, providing valuable insights and foundations for the design of this study.

3.3.2. Designing Research Plans

After conducting the literature review, detailed research plans need to be designed. Firstly, we need to clarify the research objectives and questions, determine the types of data required for the study, and select appropriate research methods accordingly. Then, based on the research objectives and questions, suitable research methods are chosen, and corresponding data collection tools and analysis plans are formulated. A reasonable and systematic research plan is the foundation and guarantee for research work.

3.3.3. Data Collection

After designing the research plan, data will be collected according to the plan. This includes collecting relevant data through methods such as questionnaire surveys, in-depth interviews, field observations, etc. Through data collection, we can comprehensively understand the current status of students' core competencies in physics and provide sufficient material for subsequent data analysis and evaluation.

3.3.4. Implementation of Intelligent Self-Driven Learning Activities

According to the research plan, a series of intelligent self-driven learning activities based on the core competencies of physics education will be designed and implemented. These activities may include the use of online learning resources, organizing project-based learning, and guiding inquiry-based learning, among others. We will ensure the diversity and flexibility of these activities to promote students' comprehensive development[4].

3.3.5. Data Analysis and Evaluation

After collecting the data, systematic analysis and evaluation will be conducted. Through statistical methods and data interpretation, we will gain in-depth understanding of the impact of intelligent self-driven learning activities on students' core competencies in physics education. At the same time, we will explore the internal mechanisms and effective strategies of these activities to provide theoretical support and guidance for subsequent research and practice.

3.3.6. Writing Research Reports

Finally, a detailed research report will be compiled summarizing the research process and results. The report will cover the background, objectives, methods used, results obtained, and relevant conclusions of the study. In addition, recommendations for future research and practice will be proposed to promote further development and innovation in physics education.

4. Research Results and Analysis

4.1. Factors Influencing Students' Intrinsic Motivation for Learning

4.1.1. Individual Factors

The study found that students' intrinsic motivation for learning is influenced by various individual factors, including their interest in learning, goal orientation, self-efficacy, and attitude towards the subject. Students' interest in the physics subject is one of the main factors influencing their intrinsic motivation. Interest can stimulate students' desire to explore physics phenomena and principles in depth, enhancing their enthusiasm for learning. Additionally, clear learning goals and high self-efficacy can promote students' persistence and effort in the face of learning challenges, thereby improving learning efficiency. Moreover, students' positive attitudes towards the physics subject also contribute to enhancing their intrinsic motivation, making them more proactive and confident in the learning process.

4.1.2. Environmental Factors

Environmental factors, particularly teachers' teaching strategies, peer interaction, and family and school environments, also significantly influence students' intrinsic motivation for learning. Supportive teaching methods by teachers, such as providing opportunities for autonomous learning, encouraging inquiry-based learning, and critical thinking, can significantly enhance students' intrinsic motivation. Positive interactions and cooperative learning among peers help form learning communities, stimulating students' interest and participation in learning. Support and expectations in the family environment, as well as school culture and atmosphere, are also important factors in promoting students' intrinsic motivation, as these factors collectively act on students to create conducive or inhibitory conditions for the development of intrinsic motivation for learning.

4.1.3. Technological and Tool Factors

Intelligent self-driven learning tools, such as online resources and simulation software, provide rich learning materials and interactive platforms. These tools meet students' personalized learning needs, enhance learning efficiency, and thereby strengthen students' intrinsic motivation for learning. Particularly in physics learning, through simulated experiments and virtual practical activities, students can intuitively understand physics concepts and principles, enhancing the interest and practicality of learning.

4.2. Implementation Effects of Intelligent Self-Driven Learning Mode

4.2.1. Increased Interest in Learning

After implementing the intelligent self-driven learning mode, students' interest in the physics subject significantly increased. Through the design of personalized learning paths, students can choose learning content according to their interests and learning pace, which greatly increases the attractiveness of learning. No longer confined to traditional classroom teaching formats, students can explore the world of physics in a more diverse and intuitive way through various learning resources such as videos, simulated experiments, etc., stimulating their curiosity and desire for exploration of knowledge. This personalized learning experience makes students more willing to engage in learning, thereby improving their enthusiasm and effectiveness in learning.

4.2.2. Enhanced Autonomous Learning Ability

The intelligent self-driven learning mode promotes students to actively explore knowledge, ask questions, and solve problems through the provision of rich online resources and interactive platforms, thereby enhancing students' autonomous learning ability. Learning becomes a process of actively seeking solutions rather than just passively receiving knowledge. Students learn how to actively participate in the learning process by utilizing network resources and tools, engaging in discussions with classmates, interacting with teachers, and practicing operations, etc., thereby actively acquiring knowledge, solving problems, and cultivating critical thinking and autonomous learning abilities. This autonomous learning ability not only has a positive impact on students' current learning but also lays an important foundation for their future lifelong learning[5].

4.2.3. Promoting Innovative Thinking and Problem-Solving Skills

The intelligent self-driven learning mode encourages students to propose original insights and engage in creative thinking. In physics learning, through solving practical problems and participating in simulated experiments, students can learn physics principles through practice, enhancing innovative thinking and problem-solving skills. They are not just passively imparted knowledge but are stimulated to think, question, and apply what they have learned through practice. This learning method cultivates students' practical and hands-on abilities, making them more creative and flexible in problem-solving, laying a solid foundation for future scientific research and engineering practices.

Through the implementation of the intelligent self-driven learning mode, students' interest in learning, autonomous learning ability, and innovative thinking skills have been significantly enhanced, laying a solid foundation for their comprehensive development and future learning and work.

4.3. Strategies for Enhancing Core Competencies in Physics Education

4.3.1. Optimization of Learning Resources

To enhance core competencies in physics education, schools and teachers should strive to integrate and optimize learning resources. This includes using modern information technology to provide rich and diverse learning materials. For example, recording video lectures, developing simulation experiment software, and building online interactive question banks can provide students with more attractive and interesting learning resources. Such measures not only meet students' personalized learning needs but also stimulate their interest in learning, improving the effectiveness and quality of learning.

4.3.2. Innovative Teaching Methods

Teachers should continuously innovate teaching methods to stimulate students' interest in learning and enhance their core competencies. For example, project-based learning, inquiry-based learning, and other teaching methods can be adopted to guide students to actively explore physics phenomena and principles. Through practical activities such as experimental operations and observation analysis, students' scientific inquiry abilities and innovative thinking can be cultivated. Additionally, teachers should encourage students to ask questions, conduct group discussions, and engage in cooperative learning to enhance the interactivity and collaboration of learning, fostering students' teamwork spirit and communication skills.

4.3.3. Establishing Evaluation Systems

Establishing an evaluation system guided by students' core competencies in physics education is crucial for enhancing students' core competencies. Evaluation criteria should not only include students' mastery of knowledge but also assess their inquiry abilities, innovative abilities, and practical abilities, among others. To achieve this, diversified evaluation methods such as peer evaluation, self-evaluation, and project evaluation can be used. Through such evaluation systems, students can be motivated to develop comprehensively, promoting the enhancement of their core competencies and achieving the comprehensive goals of education.

By implementing the above strategies, schools and teachers can better promote the enhancement of students' core competencies in physics education, laying a solid foundation for their future learning and development[6].

5. Conclusion

Through theoretical exploration and practical application, this paper demonstrates that in the context of the "cloud era," the intelligent self-driven learning mode based on the core competencies of high school physics significantly promotes the development of students' core competencies in physics education. The intelligent self-driven learning mode not only enhances students' autonomous learning abilities and innovative thinking skills but also provides teachers with new educational methods and approaches. In the future, it is necessary to further deepen the application of this learning mode and explore more personalized and efficient educational strategies to better adapt to the needs of education in the new era. At the same time, it is encouraged for educators and researchers to continue to conduct in-depth exploration and empirical research in this direction, contributing to the reform and development of education in China.

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