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Developing the Core Physical Literacy of Junior High School Students through Performance Evaluation in Project-Based Learning

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Abstract: Judging the development level of students' core literacy requires evaluation. Physics learning evaluation should focus on promoting students' development and be conducted based on the core literacy of physics courses, with the main purpose of promoting students' learning improvement and teachers' teaching improvement. "Research on the Performance Evaluation of Students' Independent Innovation Experiments" is based on the analysis of the development trend of education evaluation in the context of core literacy and has important practical significance for cultivating students' core physics literacy and optimizing experimental teaching. Taking the relationship between acceleration, force, and quality as an example, this paper discusses and analyzes the performance evaluation based on core physics literacy in high school physics experimental teaching, with a view to promoting the development of students' core physical literacy.

Keywords: *Core Physical Literacy; Junior High School; Performance Evaluation; Project-Based Learning*

I. INTRODUCTION

With the transformation of education in China and even the world from "teaching centered" to "learning centered", education should shift from "transmitting isolated knowledge and skills" to "cultivating students' core literacy.". Judging the degree of development of students' core literacy requires evaluation. Physics learning evaluation should focus on promoting students' development and be conducted based on the core literacy of physics courses. The main purpose is to promote students' learning improvement and teachers' teaching improvement, as the core literacy has integrity, richness, and diversity.

The Ministry of Education's "Opinions on Comprehensively Deepening Curriculum Reform and Implementing the Fundamental Task of Building Morality and Cultivating People" has become the core concept leading education reform, and the physics curriculum reform has entered a new era of development. It places core literacy at the key position of deepening curriculum reform and improving national literacy. As an important basic discipline in the field of natural sciences, experimental teaching is an important component of physics teaching, Advocating core literacy oriented experimental teaching is a value pursuit that embodies the goals of physics courses. However, the author believes that the more important significance of this experiment lies in cultivating students' ability to explore scientific experiments, forming an objective and realistic scientific attitude and responsibility, and highlighting the important position of this experiment in the core literacy of physics subjects. The content and location of this experiment determine its important significance for developing students' academic literacy.

Based on the above understanding, I designed the teaching of this experiment in combination with the characteristics of the DIS experiment, integrating the cultivation of physical discipline literacy into the teaching. To promote the reform of basic education evaluation methods and meet the needs of educational development, performance evaluation, as an important evaluation method, has emerged and is being widely concerned by primary and secondary school teachers. It refers to the observation, judgment, and evaluation of students' process and performance in solving problems or completing tasks in a specific or near real situation according to certain standards. Currently, some physics teachers are exploring how to use this evaluation method in senior high school physics experimental teaching to examine and evaluate the development level and status of students' core physical literacy. Although experimental skills tests are currently conducted in various secondary school entrance exams, the testing method and evaluation system of experimental operations have already made "operational skills" lose their original meaning, ultimately leaving students without any creativity, "It's just a tool for experimental manipulation, because experiments are not about skills but about" mechanical memory. "

II. THE PROPOSED METHODOLOGY

A. Background significance of performance evaluation research in student project-based learning

The mechanical training of experimental operation before the exam makes the young shoulders of students heavier; Due to the limitations of experimental equipment conditions in some regions, the requirements for operational assessment can only be relaxed. These evaluation methods obviously restrict the scientific implementation of experimental teaching and are very detrimental to the improvement of students' experimental abilities. From the current situation of experimental teaching and survey materials, to effectively improve the quality of high school physics experimental teaching, improve students' observation and experimental abilities, analyze, and summarize abilities, and hands-on operation abilities, cultivate students' good experimental habits, and scientific and rigorous experimental attitudes, it is necessary to carry out a reform in the evaluation of physics experimental teaching. Experimental exploration should include "asking questions", "scientific conjectures", "experimental exploration". After students ask questions and make guesses, they need to carry out experimental design instead of directly referring to the experimental devices in the textbook for experiments. At the same time, during the experiment, there were phenomena such

as "the traced point is not strictly located on a straight line" and "the straight line of the fitting point does not accurately pass through the origin".

"E" refers to being able to explain some simple experimental phenomena in experiments from the perspective of theoretical knowledge, and having the awareness of connecting theoretical knowledge with experimental phenomena; Be able to conduct a simple analysis of physical experimental phenomena, understand that expressing opinions requires evidence, and understand the importance of questioning and innovation. Able to use simple equipment to collect data under the guidance of teachers, be able to draw simple conclusions based on the data, and have a sense of communicating results and discussing issues with others; Curious about experimental phenomena, aware that experimental exploration requires seeking truth from facts, and a willingness to cooperate with others. After two years of physics learning, students need to conduct a scientific and comprehensive evaluation of their learning outcomes through a standardized professional evaluation program. In terms of the quality testing content of physical experiment teaching, in addition to the basic experimental conclusions, practical activities such as students' practical operations, situational experiences, and personal insights can also be included in the experimental teaching evaluation system. Using the PTA scale method can make the performance evaluation of "student independent innovation experiments" more scientific, standardized, and operable.

Based on the PTA scale method and taking the learning evaluation of the "buoyancy" theme unit as an example, the author explores how to construct an evaluation model for physical experimental ability, thereby contributing to the "Research on the Performance Evaluation of Students' Independent Innovation Experiments Based on the PTA Scale Method". Understand the experimental objectives and principles, and under the guidance of the teacher, be able to connect basic instruments according to the circuit diagram, correctly check the circuit connection. Hands-on experiments are relatively unfamiliar and have not developed good operating habits. Be able basically to accurately read the readings of ammeters and voltmeters and be basically careful in the process of exploring experiments.

At the same time, pay more attention to cooperative learning, and try to organize limited experimental data, However, it is not possible to independently design tables to record experimental data, independently use U-I images to analyze and process experimental data, and objectively analyze and evaluate experimental results. During the discussion on how to measure acceleration, students responded enthusiastically. Although there is a more detailed introduction to the split displacement sensor in this lesson, the answer for most students is how to use a photoelectric gate sensor to measure acceleration.

B. Reflection on the Performance Evaluation of High School Physics Experiment Teaching Based on Physical Core Literacy

The teacher first praised the students for being able to master and flexibly use their existing knowledge, and then proposed various methods for measuring acceleration using sensors. He proposed using a split displacement sensor to measure acceleration. Exploring the relationship between acceleration, force, and mass is the focus of mechanics experiments in senior high schools and has appeared many times in college entrance examination experiments over the years. This experiment can well train students' scientific inquiry process, scientific thinking methods, and data analysis and processing abilities. It is important to cultivate students' ability to formulate experimental ideas, determine experimental plans, and analyze experimental data, The ability to form and interpret experimental conclusions plays an important role. The teaching material for Compulsory 1 of the People's Education Edition provides several experimental schemes and ideas on how to measure the force and acceleration of objects for students to reference and choose. Referring to the above evaluation framework, the evaluation criteria are refined based on specific content characteristics.

The different nature of content and themes determine the different hierarchical descriptions of evaluation elements, performance tasks, and evaluation criteria. Specific refinement also requires further architecture based on the characteristics of different learning content, and specific refinement based on a certain basic evaluation point. Performance evaluation is based on the observation of the process of demonstrating skills, which evaluates students' learning status by allowing them to complete practical tasks. For traditional physics experiment evaluation, it is mainly reflected in written examination papers. Teachers usually use traditional experimental questions to "evaluate" what students will "do", but cannot evaluate whether students have learned anything, especially in terms of scientific attitude and spirit, it is not possible to evaluate. For example, from the activity of doing experimental questions itself, teachers cannot see the students' experimental attitude, observation ability, operational skills, and actual experimental level. They can only infer and analyze the students' experimental behavior from the test results. DIS experiments provide more possibilities.

For example, in the late expansion experiment of exploring the relationship between acceleration, force, and mass, a force sensor can be used to directly measure the tension on the rope. This is something that cannot be improved in traditional experiments. In addition, digital information systems can also complete many experiments that traditional methods cannot complete. Teachers should create opportunities for students to engage in learning and design. This is extremely conducive to the expansion of students' thinking and the development of scientific inquiry literacy. To make the content and key points of the evaluation more comprehensive, in-depth, specific, scientific, and effective, the teaching objectives and experimental process of the experiment were closely combined, with emphasis on considering the behavior of students during the experimental process.

Therefore, in experimental teaching, emphasis is placed on the determination of experimental plans and ideas, the selection and assembly of experimental instruments, the operation specifications and procedures of experimental instruments, the collection and arrangement of experimental instruments, experimental communication and group cooperation, the selection and image analysis of experimental data, the formation and analysis of experimental conclusions, the attitude and motivation of experiments The writing and reflection of experimental reports observe, inquire, judge, and evaluate students' behavior during the experiment, highlighting the procedural nature of the experiment. At the same time, a five-level evaluation is conducted based on students' behavior in the experiment, facilitating teachers' feedback on experimental teaching, promoting students' true participation, exploration, and thinking during the experiment, and eliminating the phenomenon of students' "mixing experiments

and taking forms", It is conducive to achieving the teaching objectives of the course and cultivating students' core physical literacy.

CONCLUSION

The work of "evaluation and research on the performance of independent innovation experiments for students' core physical literacy" is characterized by a wide range of fields, multiple dimensions, and comprehensive content. It is necessary to research, modify, and develop during the entire development process. Evaluation should be applied throughout the entire process of junior high school physics learning, to cultivate students' physical concepts, form good scientific thinking, develop scientific inquiry abilities, and cultivate a rigorous scientific attitude and sense of social responsibility. The cultivation of core physical literacy cannot be separated from students' learning practice. Physics teaching should aim at improving students' lifelong learning ability, take the cultivation of core physical literacy as the main line, rely on students' learning practice, and use evaluation reform as the thrust to become the driving force for deepening reform.

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