A Study on the Application of Virtual Experiments in Inquiry-Based Teaching of Junior High School Physics——Take Ohm's Law as an Example

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Abstract: In the context of education informatization construction, the heavy responsibility of promoting the integration of new technologies into the classroom falls on the shoulders of educators. With the increasing maturity of virtual technology, a new classroom form gradually comes into our view. In this study, we use "Physics Lab" to carry out inquiry-based teaching, provide a virtual experiment platform, help students to construct knowledge through inquiry, and provide theoretical and practical references for teachers.

Keywords: Virtual Experiment; Junior High School Physics; Inquiry-Based Teaching

1. Virtual experiment to help explore

Physics has the name of the cornerstone of natural science, and in physics, experimental teaching and theoretical teaching have the same degree of value to show. In the context of the new curriculum reform, education is paying more and more attention to cultivating students' practical and creative abilities and emphasizing all-round development. Physics teachers should bear the brunt of this emphasis on conducting experimental investigations to improve the quality of classroom teaching.

For safety and other factors, many experiments cannot be conducted in the classroom, therefore, virtual experiments are gradually paid attention to, for teachers, its can enrich the teaching design and improve the achievement rate of teaching objectives; for students, its breaks the time and space limitations, can better cultivate creativity and inquiry ability. For students, it breaks the limitation of time and space, and can better cultivate creativity and investigation ability. Virtual experiment gives students better visual and tactile experience through 3D scenes, visualized things and multifunctional operation platform. In this paper, we try to combine the new technology with students' independent investigation to make up for some shortcomings in the traditional classroom by combining the "Physics Lab" software.

1.1 Context creation, stimulating interest, physics experiments easy to learn

Physics contains the laws of natural science and is somewhat difficult, and students can develop a sense of fear and thus lose interest in learning. Therefore, it is especially important to introduce the context, not only to eliminate students' fear of learning new knowledge, but also to help students develop good study habits and correct logical thinking, and to improve their overall physics literacy. In this lesson, the teacher used the skit "traffic police investigating drunk driving" as the context to start teaching, which not only can stimulate students' interest, but also can trigger students to take the initiative to think and make valuable conjectures, and provide ideas for subsequent experimental investigations.

The class begins with the teacher mirroring the intercepted skit clip onto a large screen. After the play, the teacher pulls the students' attention back into the classroom, "Class, how do traffic police test whether a driver has been drinking?" The students recall the content of the skit and associate the driver with blowing on the breathalyzer to test how much alcohol has been consumed. The

teacher records the students' statements on the board and groups them together. The teacher first guides the students to draw a circuit diagram with their prior knowledge, and then enters the virtual lab to explore the principles. The virtual lab is a creatable space where students have a first-perspective immersive experience in a 3D environment. In this experiment, since there is no alcohol gas sensor in the virtual lab and it is difficult to control its value artificially, in order to uphold the principle of controlled variables, after the teacher analyzed the principle, the students discussed how to improve it in their groups and completed the grouping of the circuit (Figure 1).

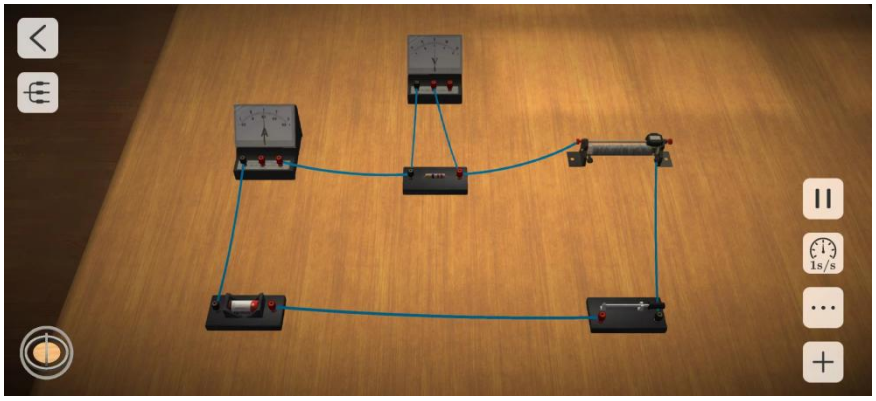

Figure 1

1.2 Teamwork, group inquiry, skills law to feel through

As an important part of this lesson, the experiment is related to the teaching effect of this lesson. Before the experiment begins, the teacher introduces the three main sections of the "Physics Lab" and chooses the electricity experiment module to let students explore the items, components, gyroscope viewpoint switching and other functions in the electricity lab to capture the curiosity of students in contact with new things, and guide them to explore through questions, such as how to switch the angle to observe the experiment? Driven by the questions, students explore independently and gradually feel the wonder of combining physics with technology. After proficiency, students will not only be able to conduct experiments based on what they have learned, but also explore experiments they have not learned, so that they can understand the circuit grouping rules of general electrical experiments and master the precautions and operation skills in electrical experiments.

The teacher guides students to observe and make reasonable guesses: after the switch is closed and the position of the sliding resistor paddle is changed, how do the values of the ammeter and voltmeter change in a regular manner? Group members record the data and summarize the law. When all groups have made their conjectures, a representative speaks and the teacher records the speech on the screen, at which point the students are guided to refine their conjecture that: in the same circuit, the conductor The current in the conductor is related to the voltage at both ends of the conductor voltage is proportional to the conductor's resistance is inversely proportional to . After refining the conjecture, students perform the experimental design. The design scheme and values can be different among groups, and multiple schemes can be designed within the group. After the experimental design is completed and then the experiment is conducted, all group members should participate in it, give rationalized suggestions and record them, and exchange reflections after the experiment is finished. Secondly, the teacher scores the experiments according to each group, and motivates the students through inter-group competition. After the experiment, the teacher plays the video, students summarize and correct their mistakes, and teachers and students summarize the conclusion together to deepen students' impression of the experimental process and conclusion. Experimental link students as the main body, the teacher through the problem and task drive students to actively explore the experiment, students in the process of problem solving, achieve the goal to build knowledge, experience the fun.

1.3 Assessment and reflection, exchange of results, and construction of a new system of knowledge

During the experiment, students often have questions about unexpected phenomena and differences in phenomena and data between groups. Therefore, it is important to exchange and evaluate the opinions and results between groups after the experiment to elicit cognitive conflicts among students. The teacher will upload the experimental data of each group, display and discuss the results, and discover the questions, such as "In the experiment, why does the current count 0 after the switch is closed?" and "Why does the

paddle position slide to the maximum?" After a series of questions surfaced, the group grabbed answers, and the teacher recorded and summarized them, guiding students to understand the correct answers, thus allowing the construction of a more complete knowledge system. After the exchange, the teacher asked the students about the principle of alcohol detector to help them connect theory with life and improve their ability to combine theory with practice.

2. Virtual Experiment Casting Capability

2.1 "One experiment, multiple scenarios, together" to develop students' decision-making skills

Decision-making ability is the ability to propose multiple solutions to a problem based on existing knowledge and experience, and to select the best solution using scientific methods and approaches. For students, decision making ability is the mastery of knowledge and methods and the ability to analyze and solve problems. In this experiment, there are multiple solutions in one scenario, and the experimental phenomena and conclusions are compared, so that the best solution can be selected and the students' decision-making ability can be practiced through the form of "multiple solutions".

Example: How does the experiment proceed without an alcohol gas sensor?

Option 1: Experimentally collect data by connecting several resistors of different resistance values in series in the circuit.

Option 2: Use a sliding rheostat in the circuit and slide the scratch pad to change the resistance value so as to conduct the experiment to collect data.

Evaluation: The test method of program one is more tedious, need to disconnect and reconnect the circuit several times, and have to count the experimental data several times to see the law. Option 2 uses a sliding varistor instead, and after connecting the circuit, the sliding paddle can directly view the data, which makes it easier to find the pattern, avoid repeating steps, and reduce errors. This kind of inquiry training can train students to think about the problem from multiple perspectives, find solutions in all aspects, and indirectly improve decision-making ability.

2.2 "Virtual experiments, resourceful, independent training" to develop students' self-learning ability

This lesson emphasizes the student as the main body and stimulates students to take the initiative to think. The teacher guides students to use the resources of the network platform and virtual laboratory for independent learning and training, to cultivate the ability to find problems and solve them effectively; to cultivate the ability to apply what they have learned through independent application; to strengthen their own weak links, to achieve independent improvement, and to cultivate the ability to learn from one to three. After students have the ability of independent learning, it is easier to stimulate their own interest, and it is better for consolidating old knowledge and understanding new knowledge.

3. Conclusion

This paper studies the application of virtual experiments instead of traditional experiments in the inquiry-based classroom of physics subjects, and further analyzes the possibilities brought by virtual experiments and the enhancement of students' abilities. In summary, with the rapid integration of technology and education, virtual experiments will become a supplement to physics subjects, which can not only make up for the lack of equipment, but also avoid many experimental safety hazards and provide a safe and scientific experimental platform for teachers and students. Reasonable use of virtual experiments, teaching effectiveness and teaching quality will have a higher room for improvement, there will be more and more educators to try to reasonably combine the basic requirements of the experiment to improve the adaptability of inquiry-based teaching.

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