DEVELOPMENT OF RESEARCH SKILLS IN PUPILS THROUGH LABORATORY WORK

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Abstract: This article explores the possibilities of developing research skills in students through home laboratory work in the field of physics.

Keywords: Homework, physics, school, experiment, laboratory work.

Physics is an experimental science. An experiment is a test, i.e., the observation of a phenomenon under controlled conditions, which allows for its replication by consistently repeating the same conditions. Therefore, understanding and comprehending physical theory is impossible without experimental verification. This implies fostering an active and independent stance in pupils during the learning process, developing their general academic skills primarily those related to research and self-assessment cultivating competencies connected to applying knowledge in practice, prioritizing the development of pupils cognitive interest, and implementing the principle of linking learning with real-life situations. The essence and purpose of modern education lie in developing an individual's general abilities and personal modes of action through the interaction of educational subjects. The role of the teacher as an organizer of pupils activities in school is of particular importance. Indeed, the role of physical experimentation should not be overlooked, as pupils experimental skills are developed through hands-on experiences. During such experiments, they learn to identify the objectives of the experiment, formulate problems and find solutions, propose hypotheses and either verify or refute them. Additionally, they acquire

skills in assembling equipment, observing phenomena from the perspective of physics, and validating those observations accordingly.

At the initial stage of secondary school, the use of home laboratory work in the study of physics is recommended. This approach is particularly relevant in situations where the number of instructional hours allocated to physics in the school curriculum has been reduced, while the volume of material remains unchanged. In other words, students are still expected to acquire the same amount of knowledge as before, but within a shorter period of time. Unfortunately, many practicing teachers tend to reduce the experimental component of their lessons. In modern schools, physics experiments are typically categorized into demonstration experiments, frontal laboratory work, and physics workshops. Only a few methodological teachers distinguish a separate category of local experimental (laboratory) work. We consider it essential to introduce home laboratory activities during the early years of physics education—particularly in grades 7 to 9 of the middle school physics curriculum—by assigning them as homework on weekends.

Often, the physics content presented in books and textbooks remains unclear to students for an extended period. This lack of understanding leads to a decline in interest in the subject, which in turn results in misconceptions and a decrease in academic performance. How can pupils interest in science be stimulated? How can the educational process be organized in such a way that it fosters exploration and creativity, while also creating an atmosphere of joyful engagement? What methods can be used to make learning activities more engaging and effective?

For students, organizing observations, experiments, and scientific research in learning physics is a necessary factor that increases interest in the subject, makes it both exciting and useful, and also provides an opportunity to understand that physics is fascinating. Nowadays, in the field of education, new criteria for assessing the quality of education, taking into account the development dynamics

of each student, are increasingly gaining importance. This is related to the increasing pace of changes in society: technological advancements, changes in lifestyle, the emergence of new products and needs, and the transformation of labor forms. Those who can create unique products or services within a limited time, reconstruct new methods of work, and master them, as well as propose unconventional solutions in challenging situations, are the ones who carry out certain competencies. The need to quickly find solutions to emerging production and scientific problems has led to the widespread adoption of independent work as a technology for solving problems. Successful specialists are those who, if established in school, are bound to be present. As a result of pupils continuous independent activities, this becomes one of the most important forms of modern education.

Home experiments are the simplest activities carried out by students at home, outside of school, without direct supervision by the teacher, though sometimes in collaboration with parents. The aim of such activities is to develop the ability to observe physical phenomena in nature and at home, to carry out measurements using measurement tools commonly used in daily life, and to foster an interest in experimenting and studying physics. Students can perform these types of tasks using tools they create themselves, household items, or tools available in stores. Home experiments are rightfully included in the system of school experiments, and their particular significance lies in the fact that they can be classified as an independent work system. This can increase interest in physics and also provide an opportunity to observe the connection between physics and other subjects. [4]

For independent work, simple tasks that gradually increase in complexity and are easily solvable should be assigned in the lower stages of studying the topic. This type of work is individual, even if a single laboratory task is given to the entire class, as students need to complete it at home without the teacher or classmates. The distinctive feature of home laboratory work is that the teacher

does not take into account the fact that different students complete tasks at different speeds when preparing assignments. This allows the opportunity to give the same task to all students. Home experiments should be conducted in the form of homework on a specific topic or be checked after studying a particular subject or theme.

Experiments conducted at home can also be part of the educational process. In this case, students are required to create certain conditions within a given time frame, observe the events occurring, and then draw conclusions about what they have seen. The role of independent work is very high when performing home laboratory tasks. They contribute to increasing pupils interest in the subject, which, as mentioned above, is important. Therefore, when preparing educational programs, the teacher should give more attention to these types of activities, always incorporating independent work. Independent work develops the ability to solve problems without external assistance, which will be useful for students in their future lives. Home laboratory work must meet specific requirements. [7]

All experiments conducted by students at home must not cause any harm, so one of the main requirements is safety. Home laboratories should not be a source of danger. When working with hot objects, the description of the laboratory work should specify that it must be carried out with the participation of parents. Since laboratory work is carried out at home, it is not necessary to use any complex equipment, and the materials used by students in each home should not lead to any additional financial costs. Although home laboratory work should be easy to perform, it carries a significant theoretical load. The description of the laboratory work should include not only step-by-step instructions but also the theory that helps students not only explain the observed phenomena but also review the material they have learned. Reports on the progress of the work should be filled out. The teacher should discuss the format of the reports with the students in advance, for example, this may require students to register in their previous

laboratory work; such a report format will help the teacher evaluate the work of each student. The results should be discussed with the class; this will help students understand any questions they found unclear during the process. Thus, the experiments chosen by the teacher for the home laboratory should meet the following requirements:

1. Safety.
2. Ease of implementation.
3. No material costs.
4. Reports on the progress of the work.
5. Discussion of the results.

Conducting home laboratory work is also related to the psychological development of children during their adolescent years. This period is the shortest, but it is when a person makes significant progress in their development. It is during this time that they become an individual. Furthermore, it is important to consider the development of higher cognitive functions at this age, such as memory, attention, perception, and thinking in general. The development of these functions is linked to motivation for learning, and during adolescence, theoretical thinking prevails, helping the child learn to establish connections. It is known that when learning physics, students show the greatest interest in performing independent practical tasks both during lessons and in extracurricular activities. Therefore, using a physics experiment when completing homework is logically appropriate. At the elementary stage of education, in the 7th grade, the large number of home laboratory tasks ensures a solid foundation for the theoretical knowledge the child gains during their independent work. Considering that not much time is allocated to learning physics in grades 7-9, performing laboratory work at home will not lead to overloading and will be given on weekends so that students have time to conduct experiments and interpret the results. Students are encouraged to organize a home laboratory, where a list of necessary equipment

and a clear algorithm for conducting the experiment are provided. During the work process, students deepen their knowledge, review lesson materials, develop memory and thinking, learn to analyze results and experiences, and independently draw conclusions. The tasks evoke a sense of awe, joy, and pleasure in students from the work they have done independently, as the positive emotions experienced help solidify the necessary information in memory for an extended period.

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