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METHODS AND TECHNIQUES FOR SETTING UP EXPERIMENTS IN PHYSICS LESSONS ESHTUXTAROVA ORZIGUL SHONAZAROVNA

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Abstract
Laboratory work is a teaching method in which students understand physical phenomena. Laboratory work is a teaching method in which students understand physical phenomena. At the frontal laboratory work, concepts are formed as the main element of scientific knowledge, the initial ideas about phenomena are developed and deepened, the connection between science and technology is traced, interest is developed that promotes independent activity, and in general the gap between theory and practice is overcome.
Keywords: laboratory work, *training and education, environmental education,* promotes independent activity

INTRODUCTION

In physics, the source of knowledge and the method of research is experiment. A school educational experiment is a reflection of the scientific method of studying physical phenomena, therefore, although it is not identical to the scientific one, it must have the basic elements of a physical experiment, by which students can get an idea of the scientific experimental method. An educational experiment is a reproduction with the help of special devices of a physical phenomenon (less often, its use in practice) in a lesson in conditions most convenient for its study. Therefore, it serves simultaneously as a source of knowledge, a teaching method and a type of visibility. It is generally recognized that the presentation of a physics course in secondary school should be based on experiment. This is due to the fact that the main stages in the formation of physical concepts—the observation of a phenomenon, the establishment of its connections with others, the introduction of quantities that characterize it—cannot be effective without the use of physical experiments [1-3].

METHODOLOGY

Demonstration of experiments in the classroom, showing some of them with the help of films and television, and the performance of laboratory work by students form the basis of the experimental method of teaching physics at school. Being a means of cognitive information, the educational experiment is at the same time the main means of visualization in the study of physics; it allows the most successful and effective formation of specific images in schoolchildren that adequately reflect. In their minds, there are real physical phenomena, processes and laws that unite them. A physical experiment is not only an illustration of certain phenomena and regularities: it serves as a means of proving the validity of various theoretical

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positions, contributes to the development of confidence in the cognoscibility of natural phenomena, and develops the skills of students [3].

A properly organized school physical experiment also serves as an effective means of educating such personality traits as perseverance in achieving the set goal, thoroughness in obtaining facts, accuracy in work, the ability to observe and highlight their essential features in the phenomena under consideration, etc. To give students deep and strong knowledge, to form important practical skills in them, coordination is necessary in the application of various types of educational experiment:

- demonstration experiments;
- frontal laboratory work;
- works of a physical workshop;
- extracurricular (home) experiments.

All these types of educational experiment ensure the implementation of the principles of visibility, consciousness, active cognitive activity of students, polytechnics in teaching physics [2]. The experimental and methodological activity of a physics teacher is multifaceted: from the analysis of the phenomenon and the choice of the experimental scheme to the assembly of the experimental setup and its reasonable application in the classroom. The complexity of this activity of the teacher is reflected in the content of the concept of "methodology and technique of school physical experiment". The demonstration technique is understood as the conditions that ensure the greatest effect (in the technical sense of the word) of the demonstration experience and its best direct perception by students while observing safety rules [4]. It is quite clear that the effect of any experiment primarily depends on the quality of school physical instruments. First of all, the following requirements are imposed on them: high technical qualities, simplicity of the device, sufficiently large dimensions, and aesthetic design.

The demo setup should be as simple as possible. This is essential for understanding experience and its implications. In installations, devices should be used that are known to students or the principle of operation of which is accessible to their understanding. However, as the history of the development of methods of teaching physics testifies, the simplicity and complexity of a particular demonstration are relative concepts. So, until recently, experiments showing the properties of electromagnetic waves, the polarization of light, and the laws of the photoelectric effect were considered complex and almost never performed in high school [3].

With the appearance in the arsenal of physical classrooms of such instruments as a set of instruments for studying the properties of electromagnetic waves, a school electronic oscilloscope, a set of instruments for studying the polarization of light, these experiments became widespread.

Meanwhile, for the needs of everyday practice, it is useful to at least approximately define the concept of "simple demonstration installation". Obviously, this can be done this way: a simple demonstration installation is considered to be as close as possible to its circuit diagram, but only so much that it does not noticeably reduce the quality of its work. It is clear that natural scientists, the creators of experimental installations, when creating them, do not set themselves the task of making them suitable for teaching, they pursue a different goal. In the methodology of physics, the process of adapting experiments, first staged in scientific laboratories, to the tasks of teaching is being carried out. This process proceeds by simplifying the experimental setups, eliminating from them everything that does not serve to elucidate the essence of the

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physical phenomenon under study (only simplifications that vulgarize scientific results are unacceptable).

RESULTS AND DISCUSSIONS

The success of setting up a demonstration experiment depends not only on the quality of the devices themselves, but also largely on the knowledge of the teacher of the physics of the device, technical data and skills in operating these devices, the conditions for conducting the experiment itself, and the intensity of the physical process being demonstrated. Demonstration experience can have pedagogical value only if the achieved effect of the demonstration is clearly visible to the entire audience of students. Here one cannot but agree with the opinion of those who believe that no matter how perfect a demonstration in all other respects, it will be unusable if the students do not so much see the phenomenon as guess about it from the words of the teacher. Good visibility of the demonstration experiment is provided by:

- special design of demonstration instruments;
- a special arrangement of the installation elements on the table (in particular, in a vertical plane);
- the expressiveness of the demonstration installation;
- special means that increase the visibility of devices and the expected effect.

The practice of advanced teachers has worked out certain methods and means that make it possible to leave insignificant details of the attitude in the shade and emphasize the main essential.

1. *Proper arrangement of instruments on the demonstration table.* There should be no utensils on the table that are unnecessary for this demonstration; installation details should not close each other; it is desirable to arrange them in the order in which they follow on the circuit diagram when reading it from left to right. Devices should be placed so that the teacher can assemble the installation and perform the necessary manipulations without leaving the table and without covering any of its elements with his hands (or body). The tripod stands must be turned towards you; hang electrical wires so that students can clearly see the entire electrical circuit; to position the devices in a vertical plane, use lifting tables, tripods and bars (the latter are usually made from “blind” plywood boxes, the opposite sides of which are painted white and black, the approximate dimensions of the bars are: 50x25x12.5 cm; 25x25x6.25 cm; these boxes-stands serve simultaneously as background screens).
2. *To enhance the illumination of the installation being demonstrated, the following illumination should be used:* directional (lamps with reflectors) and diffuse (transparent screens with illumination). The light phenomenon is demonstrated in a darkened audience.
3. *The demonstration experience must be convincing, and the installation for its implementation must be reliable.* Good visibility and expressiveness of experience, achieved by all special means, determine the persuasiveness of the demonstration, but it also depends on a number of factors. Thus, uniform rectilinear motion is often illustrated using a tube filled with liquid (water, oil) in which a metal ball moves. Under certain conditions, the movement of the ball is indeed uniform. However, in order for students to be convinced of this, it is necessary to highlight the main sign of the uniformity of movement (the same movement of the body for any equal intervals of time). Thus, for the credibility of this experiment, it is necessary to provide a fixation in the setup (noticeable for the whole class):

- equal segments of the path;
- equal intervals of time.

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All side effects accompanying the study should be kept to a minimum. If this cannot be achieved, additional experience should be shown, indicating the insignificance of the influence of a side effect on the results of the main experiment. The demonstration installation must be reliable, which excludes failures in the lesson and allows, if necessary, to repeat the experiment. Nothing undermines the professional authority of a teacher like a failed demonstration. Therefore, if the installation fails in the lesson, you need to coolly check all its nodes, find and eliminate the malfunction. If this failed, it is necessary to indicate the reason for the failure and put the experiment in the next lesson.

4. When demonstrating phenomena occurring in one plane (for example, when demonstrating rotational or oscillatory movement), it is necessary to ensure that the plane in which the movement occurs is perpendicular to the line of sight of students sitting in the middle of the class.

5. To demonstrate physical phenomena that are not directly perceived by the senses (electric and magnetic fields, invisible rays, changes in the chemical composition of matter, density, etc.), various indicators should be used. So, to detect the electric field of a charged ball, you can use light particles of cattail, to detect a magnetic field - iron filings, etc.

6. To improve the visibility of the demonstration installation or individual instruments, it is necessary to select an appropriate background against which the demonstration equipment is viewed. For this purpose, movable screens are used, having a black surface on one side and a white surface on the other. Most often, a white screen is used, against which bodies that have a dark color are clearly visible. It is advisable to use a black screen in the case of demonstrating self-luminous bodies or bodies painted in light colors (for example, to demonstrate the glow of a wire when a current passes through it).

7. *When demonstrating phenomena occurring in colorless media (for example, in colorless liquids), the latter are stained.* Good means for this purpose are fluorescein, fuchsine, phenolphthalein with a few drops of ammonia, coniferous concentrate, a decoction of table red beets. It is not advisable to tint water with potassium permanganate, ink, paints, since after the use of these dyes, the walls of the vessels are quickly contaminated. Tinting must be done skillfully and in moderation. For example, demonstrating the Archimedean force with a strong concentration of the dye, the body lowered into the water will not be visible. In this variant, the water level in the vessel and the fact that the body is lowered into the liquid are clearly visible, but it is impossible to notice that the body touches the bottom of the vessel. In other cases, it is advisable to use dyes of different colors or different intensities. To observe a beam of light in water, it is slightly tinted with either fluorescein or milk.

8. Mirrors for demonstration purposes are used in two cases:
   - ❖ when it is necessary to improve visibility on the part of students;
   - ❖ when it is necessary to provide visibility from the teacher.

In the first case, a large mirror is set at an angle of 45°, which allows students to see objects located on a demonstration table in a horizontal plane (for example, a magnetic field spectrum created using iron filings). In the second case, a small mirror is used (for example, from the FOS-67 set). It is installed so that the teacher can see the installation elements facing the students. For example, when demonstrating oscillograms, a mirror is installed in front of the oscilloscope, which allows the teacher to see the picture on the screen.

9. *To focus the attention of students on individual details of the demonstration installation, use pointers and indicators.* At the disposal of the demonstrator it is convenient to have

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indicators of direction, polarity, level, serial number, accessory. Direction indicators are mounted on a stand. The arrow is applied from two sides, which allows both the students and the teacher to see the same direction at the same time. Turning the arrow 180° around the post reverses the direction. The polarity and serial number indicators differ from those considered only in that instead of arrows on one side and the other, the same sign is applied ("+", "-", N, S, number). Level indicators can be mounted in the tripod sleeve: rods, strips of colored tape, rubber rings, etc. Accessory indicators help to highlight individual parts in a demonstration installation, united by some sign. So, in an experiment to observe the phenomenon of self-induction, it is advisable to collect parallel branches by using wires of different colors. Indicators are used when the displayed objects are difficult or impossible to perceive directly. For example, an incandescent lamp can be used to detect current in a circuit, a neon lamp can be used to detect an electromagnetic field, etc.

10. *For demonstration experiments, projection of devices onto a screen is also used.* A number of commercial display units are small in size and specially adapted for projection display. Projection can be shadow or light. Devices are demonstrated using the FOS optical system, installing them in a vertical (pumps, capillaries, etc.) or horizontal (Brownian motion model) position. For illumination and shadow projection, a special illuminator is used, in which the divergence of the light beam can be adjusted. The illuminator is used in different versions. For example, if you need to highlight some detail of the experiment, then with the help of an illuminator, the angle of beam divergence and the place from which this detail can be most effectively illuminated are selected. To observe the state of the water surface, the installation is assembled so that the light flux coming from the illuminator falls on the screen after reflection. This is how mechanical waves on the surface of a liquid, the spreading of oil over the surface of water, and other experiments demonstrate. Using an illuminator, for shadow projection it is possible to demonstrate the operation of an electric bell, etc. Projection onto a screen makes it possible to show the details characterizing a physical phenomenon in an enlarged form. This is especially important when the dimensions of the instruments or changes in the course of the phenomenon being demonstrated are insignificant (for example, the rise or fall of a liquid in a capillary, the growth of a crystal. However, it must be borne in mind that observation of a phenomenon in nature is always preferable to its projection; the latter is used only when when other means are ineffective [5].

Summarizing everything that has been said about the demonstration technique, we emphasize that when preparing this or that experiment, the teacher solves three main questions:

- the choice of the location of each element of the installation, demonstrating the phenomenon under study, in a horizontal or vertical plane;
- the use of lighting and background (usually black, white or translucent matte);
- selection of the most suitable indicators for the best observation of this process.

The visibility of the demonstration experiment is provided with the help of special tools:

- Tripods, tables, benches, stands provide an arrangement of instruments that is convenient for observation.
- Screens (white, black, color, backlit) allow you to create a background and highlight the experimental setup as a whole or its individual parts.
- Pointers (in the form of large bright arrows) allow students to focus on individual details of the experimental setup.

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- Indicators (incandescent lamp, neon lamp, measuring instruments, sound, etc.) make visible those objects that cannot be perceived directly (electric current, magnetic field, etc.).
- Tinting liquid provides a clear fixation of its level and volume.
- Shadow projection allows you to increase the experimental setup or its individual parts (the Brownian motion model, the pendulum in the clock, the Rutherford experiment model, the spectra of electric and magnetic fields, etc.).
- Mirrors provide improved visibility for the teacher (for example, when working with an oscilloscope) and for students when conducting experiments in the horizontal plane (spectra of electric and magnetic fields).
- Wires of different colors are used when assembling parallel electrical circuits.

The considered means of visualization of the demonstration experiment are selected for the experiment after determining the object of the experiment and the object of the demonstration. The object of the experiment is a set of instruments and accessories involved in the demonstration experiment. The object of the demonstration is a part, a detail of the experimental setup, changes in which reveal the essence of what is being demonstrated. It is to the object of the demonstration that the attention of students should be drawn with the help of special means. So the scales and arrows of all measuring instruments should be large and contrasting. Coloring the water will increase the visibility of the "Hydrostatic Paradox" experiment, but will reduce the visibility of the "Archimedean Force" experiment [4].

In experiments with a universal tripod, the background approaches the object fixed in its foot. On a white background, the tripod will be clearly visible, which will distract the students' attention from the demonstration object. Qualitative preparation of the experiment for classes requires considerable time. However, we note that only an experiment that is set up for the first time requires a lot of time to establish; repeating it in the future requires much less time. In order to consolidate the acquired experience of showing a demonstration and not to forget its “subtleties”, on which the success of the experiment depends, it is best to keep a file of demonstrations, where it is necessary to record the “secrets” and individual features of the devices in your physical office. For this purpose, a card is created for each demonstration experiment, on the front side of which the following data is indicated: class, topic being studied, lesson topic, name of the demonstration, scheme (sketch) of the installation. On the reverse side of the card, a list of devices, their features, the optimal mode of operation, and individual comments are recorded.

The pedagogical effect of any demonstration experiment, i.e. the most complete perception and comprehension by students can be achieved only with a certain method of showing experience. The methodology of a demonstration experiment is a set of methods, techniques and tools that ensure the effective inclusion of demonstration experience in the learning process. The demonstration experiment methodology involves determining the place of the experiment in the lesson, its didactic possibilities and the sequence of conducting it together with the teacher's explanation, finding the optimal combination of the demonstration experience with other visual aids, selecting questions for students when discussing the results of the experiment, etc.

CONCLUSION

The basic methodological requirements for demonstration experiments determine the rules for their conduct, which the teacher must always adhere to. One of the first methodological

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requirements is the organic connection of the demonstration experience with the presentation of educational material in the lesson. That is why the vast majority of demonstration experiments are of a qualitative nature.

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