

THE ORGANIZATION OF PHYSICAL EXPERIMENTS IN TEACHING PHYSICS

Mehriniso Farkhodovna Atoeva

Associate Professor, Department of Physics, Bukhara State University, Bukhara, Uzbekistan.

E-mail: atoeva@umail.uz

ABSTRACT

This article describes the methodology for organizing experimental classes in the subject of physics on the basis of the State Program in the subject. The techniques and experiments can be used by teachers in teaching subject physics and recommended as a practical and methodological indication for young teachers in organizing students' independent work in groups and individually, using modern information and pedagogical technologies in the educational process.

Keywords:

Model of physical education, development, pedagogical trends, educational process, pedagogy, training, teaching methods, General education, Humanities, natural science, physics and mathematics, technical, experimental training, educational process, learning effectiveness, practical skills.

Article Received: 18 October 2020, Revised: 3 November 2020, Accepted: 24 December 2020

Introduction

In world education, it is becoming increasingly important to enrich the pedagogical potential of improving the quality of teaching the exact and natural sciences, in particular, the teaching of physics with practical content, improving the methodological framework in accordance with modern trends in physics. In the 21st century, education is recognized worldwide as a key factor in ensuring sustainable development, and the concept of international education until 2030 identifies "creating opportunities for quality lifelong learning" as an urgent task. This requires a qualitative increase in the level of professional and methodological training of teachers, including physics teachers, in the system of continuing education, increasing the possibility of effective use of statistical methods in the teaching process. A number of research works are being carried out on the application of advanced pedagogical technologies in the educational process, the use of opportunities for interdisciplinary integration, the creation of methodological support aimed at developing the creative abilities of students. In particular, the effective use of science in the teaching of physics, the improvement of methods of teaching problem-solving in solving practical and natural-scientific

problems, the application of scientific and methodological developments on the theoretical foundations of science in the educational process are important.

The history of the development of physics shows that fundamental generalizations are based on the achievements of philosophy, its basic categories and laws. Well-known Methodist scholar A.V. Usova writes about this issue in her book "Formation of scientific concepts in students in the process of teaching": "It is impossible to master both laws and theories without mastering the concepts. Therefore, in the process of teaching, special attention should be paid to the fact that students master the basic concepts at a high level. To reach the outcome, the teacher must properly organize and manage the process of mastering and forming concepts" [9; p.8].

Materials and Methods

In traditional teaching of physics, experiments are divided into two major groups: demonstration experiments performed by the teacher and practical (experimental) work performed independently by the students. Demonstration experiments are important in the following cases:

a) When we introduce students with physical phenomena and circumstances that serve

as the starting point for the formulation of the basic physical laws by their discoverers. As it is known, the regularities discovered during observations are generalized and formulated in the form of the corresponding "laws of nature." Sometimes such "laws" receive the names of their discoverers, for instance, the well-known Archimedes' law or Coulomb's law of physics which offer a practical basis and a generalization of experience;

b) When considering the design and principles of operation of measuring instruments is based on various physical phenomena. There are many more devices that allow us to measure various physical parameters than basic physical laws. And, although each device has its own author, that is, the person who was the first to suggest and implement the design of the device, the names of the authors are usually not communicated to schoolchildren. Attention to this issue (authorship) is given only when studying the history of physics;

c) In the study of complex technical devices or processes in which various physical phenomena are used in combination.

Practical independent experimental work can also be divided into groups by purpose:

a) Qualitative experiments such as: collect - turn on - look - sketch - draw a conclusion (verbal formulation). Such experiments are needed for direct introduction with physical phenomena. For example, in such an experiment the "law of communicating vessels" is tested;

b) Quantitative experiments: collect - measure - calculate - build a graph - write the result in a notebook. This type of experiments is for developing skills in using the simplest measuring instruments and designing experimental work. For example, experiments in which different elongations of the same spring are recorded, if different weights are suspended on it. [5, p.220].

Using such methods, we can increase the interest of schoolchildren in the subject of physics and physical experiments. Based on the above, when

compiling experimental problems in physics, the following criteria were adhered to:

- The content of experimental tasks in the educational process should create problematic situations and the principles of developing learning;
- The content of experimental tasks in the educational process should not go beyond the curriculum materials;
- To solve experimental problems, the necessary formulas and patterns should not go beyond the curriculum;
- The content of experimental tasks should be purposeful, with a deep meaning, physical processes and their meaning should be directly related to production, technology, natural phenomena, modern science and technology;
- A single interconnection of the content of experimental tasks should take into account the individual qualities, psychological and physiological characteristics of schoolchildren;
- When drawing up experimental problems, it is imperative to take into account modern achievements of science and technology, advanced scientific technologies and achievements;
- The content of experimental tasks should ensure the development of various mental and real actions in practice. Based on the analysis of the necessary theoretical and practical knowledge for solving experimental problems and solving problems are impossible without a mental operation. Let us dwell on the actions necessary to solve experimental problems.

Analysis: The necessary knowledge forms the following specific tasks:

- ✓ Select one of the proposed objects or parameters;
- ✓ Consider one of the ideas from the condition of the problem, make a mathematical conclusion, prove, indicate historical data, etc.

- ✓ Be able to distinguish between the principle of operation of mechanisms, motors, machines, transmission mechanisms; and in electrical circuits - a current source, mechanisms that consume electrical energy, measuring instruments;
- ✓ Discuss the condition of the problem and indicate the "characters" related to the condition of the problem, describe the states of these bodies;
- ✓ Indicate the causes and effects of physical processes;
- ✓ Indicate the main points of the work and draw up a plan for further work.

Data collection: the formation of certain knowledge is influenced by the following factors:

- Considering various aspects of the physical phenomenon of the experimental problem, make a general conclusion (for example, determine the dependence of the electrical conductivity of metals on temperature);
- To solve various problems, create different conditions or write an abstract.

Create a grouping and general conclusion: to perform such actions, the following actions are required:

- From the list of various information data, conclusions, select only such data that characterize a real physical process (for example, choose Ohm's law for a section or for a closed circuit);
- To be able to group the considered physical devices - measuring devices into one group, physical and technical devices - into another group [1, 3];
- Full consideration of the practical application of physical laws, processes necessary for an experiment in physics (application in natural phenomena, in human life, in the social sphere, production and technology).

Such knowledge is formed by the following tasks (induction):

- Make a conclusion on many experiments and observations (for example, about the conditions

for the appearance of some physical phenomenon);

- To make a general conclusion on the problem of one fact.

To form such knowledge, it is necessary and useful to perform the following tasks (deduction):

- To supplement the proposal using knowledge from the theory, for example, to determine the state of the body, based on the electronic theory;
- Based on theory, a student on a given problem can express their thoughts, judgments;
- By the nature of the conditions of experimental problems, schoolchildren can recommend their assumptions.

To form such knowledge, it is necessary and useful to perform the following tasks (generalization):

- Indicating the foundations of the theory (definition, conclusions, concepts, ideal models, etc.), laws (postulates, laws, constants), consequences (formula-consequences of a formula, practical application and its connection), highlighting them, make a structural diagram of the theory;
- To create a logical system for solving the problem this means that the initial conditions must be taken into account to perform the work.

Results and Discussions

Classes with experimenters focus on the physical tools used in relation to the topic. The wide amplitude of the variability in the characteristics of the various measuring instruments allowed the experimenters to determine the mean of the data obtained, as well as the variability of the relationship between the characters.

Experimental work shows that in the theory and practice of teaching physics, a certain amount of experience has been accumulated in solving the problem under consideration. However, in all cases, in the course of experimental work, a number of shortcomings in the theory and practice of problem learning with the use of interdisciplinary connections are revealed: a system for using interdisciplinary

connections for some topics in the physics section has not been developed. As the presentation of textbook material is far from problematic and problem assignments are not used enough and as a result students are not interested in the subject.

Analysis of methodological literature, curricula and textbooks, taking into account the basic principles of the subject of physics allow us to establish interdisciplinary connections of various school disciplines necessary for a more complete and conscious assimilation of the course of physics, including the experimental part of the subject, to design and substantiate a system of problematic tasks of an interdisciplinary nature in the course physics, which are the main means for shaping cognitive activity and developing the thinking of students using problem learning. In this case, methodological conditions are determined that ensure the effective formation of students' cognitive activity when using inter-subject connections in problem learning.

Teaching students using interdisciplinary connections in problem learning contributes to:

- Solving a problem - teaching to think by reducing factual material,
- The development of thinking
- Perception of the picture of the world as a whole.

A set of methods for teaching students in the context of pedagogical integration has been identified and experimentally tested, such as: modeling, interactive methods of individual learning, experiments to show in a virtual way, the method of creative design, the implementation of which makes it possible to simulate the future activities of specialists in the learning process, with the formation of professionally important qualities, and namely: the ability to self-study; the concept of theoretical and practical relationship of the considered physical phenomenon; the ability to independently solve the problem; development of research skills while performing experimental work; the ability to correctly, logically and concisely write a description and draw conclusions; good proofreading skills.

Let's look at some experimental experiments for an example.

1. Paper lid and atmospheric pressure.

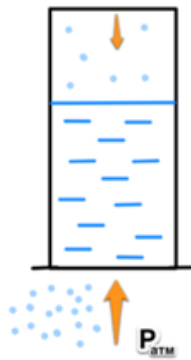
Description: Atmospheric pressure is the pressure of air on the earth's surface and on all objects in the atmosphere, created by the gravitational attraction of the Earth. It spreads in all directions with equal force. If we tilt a glass filled with water, water will begin to pour out of it, as gravity acts on it and nothing prevents the liquid from rushing down. In order to prevent water from spilling out of the vessel, we can go in several ways. We close with a tight lid, freeze and do not turn the glass over. Or, finally, we don't pour it there.

But we are not looking for easy ways.

Let's try to create conditions under which the water in the vessel is held by atmospheric pressure, despite the force of gravity.

Cover the flask filled with liquid with a paper sheet, press it tightly with your hand, turn it over and hold it in this position for some time. The water wets the surface of the paper, and it "sticks" to the walls of the flask due to surface tension forces. Then we slowly remove our hand and observe the declared result.

Between the bottom (which is now at the top) and the surface of the water, a space is formed, filled with air and water vapor. The column of water tends downward under the influence of gravity, increasing the volume of this very space. At a constant temperature, the pressure in it drops, that is, in relation to atmospheric pressure, it becomes lower. And the less this pressure, the greater the column of liquid, theoretically it can hold up to 10 m. So, the sum of the air and water pressure on the paper from the inside is slightly less than the atmospheric pressure outside. See (1-fig.) However, it will not last forever. After a while, the evaporation of water will increase the air pressure and it will become equal to atmospheric pressure. Strength, plasticity and wet ability of paper, water temperature, curvature of the vessel surface also affect the tear-off speed.



We need for the experiment:

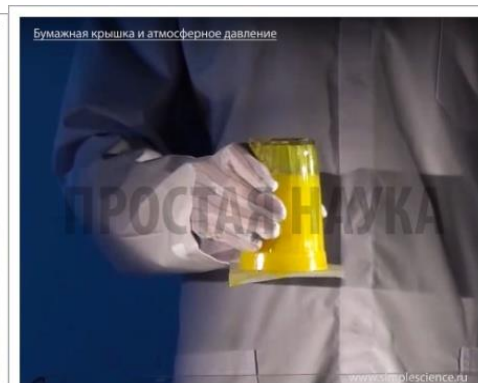
| | |
|---------------------|----------------------------------|
| Dishes: | Glass |
| Consumables: | acrylic paints, a sheet of paper |

Experimental stages:

1. Fill the glass with water.
2. Add a little paint to the water for beauty,.
3. Put a sheet of paper on top of the glass.
4. Hold the sheet with your hand, turn the glass over and remove your hand.



2-Picture



3-Picture

1. Fill the glass with water and tint the water with paint to change the look (See picture 2)
2. Put a sheet of paper on top of the glass. Holding the sheet with your hand, turn the glass over and remove your hand (See picture 3)

Water is not poured out of the flask due to the force arising from the difference in atmospheric pressure outside the vessel and the pressure that forms inside between the bottom and the surface of the water. Water is not poured out of the flask due to the force arising from the difference in atmospheric pressure outside the vessel and the

pressure that forms inside between the bottom and the surface of the water. When the water column try to go down and a reduced pressure environment forms in the container which retains the liquid.

1. Water flows upward. The experience illustrates how the process of absorption of liquid by a solid body, namely a napkin, takes place. The napkin has a porous structure and consists mainly of cellulose, which, in turn, has a fibrous structure. Thus, it is not difficult for water to find its way-capillaries to move upward (See the picture 4).



Picture 4



Picture 5



Picture 6

1. Cut a strip out of the napkin (See picture 5).
2. Apply colored dots in one row with felt-tip pens (See picture 6).

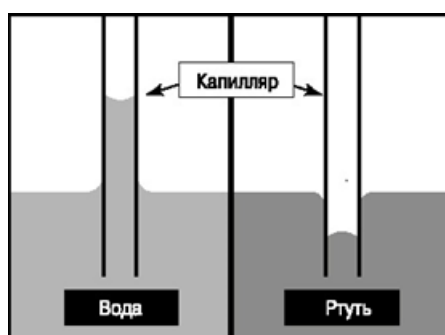
Description: Water is a unique substance. For all the prevalence and simplicity of its composition, its physical and chemical properties are often the exception. So, for example, at 4°C the density of water is maximum, and when it goes into a solid state (ice), it decreases! No other substance behaves in this way. As for this experience, everything seems obvious and simple at first glance. The water will wet the paper and string and the materials will get wet. However, it is difficult to explain why it is happening. Let's understand, for a start, in the very term "wetting". It is the phenomenon of the interaction of a liquid with the surface of a solid. There are always two options for the development of events:

- the attraction between liquid molecules is stronger than their attraction to solid molecules. The liquid tends to reduce contact with the surface and, as a result, collects in droplets.

- the attraction between liquid molecules is weaker than their attraction to solid body molecules. The fluid tends to increase the area of contact and, as a result, is pressed against the surface of the body, spreading over it.

Obviously, here is the second option. Spreading occurs until the liquid covers the entire surface, or until the liquid layer becomes monomolecular. But how does water overcome the forces of gravity? Actually, the same as in plants. Water rises up the capillary vessels of the plant and delivers it from the roots to the leaves and fruits.

This is due to the difference in pressure and surface tension forces of water. The surface of water entering a narrow capillary takes a concave shape (meniscus). In this position, the pressure of the liquid under this meniscus becomes less than atmospheric, and the water tends upward. And the thinner the capillary, the higher the water rises, trying to balance the negative pressure. If the liquid does not wet the surface, then the meniscus will be convex, and it will not rise up the capillary. (See picture 7).



The napkin has a porous structure and consists mainly of cellulose, which, in turn, has a fibrous structure. Thus, it is not difficult for water to find its way-capillaries to move upward (See picture

5). In a twine, the processes proceed in a similar way, with the only difference that its mechanical properties are not violated, since it consists of solid threads.

We need for the experiment:

| | |
|--------------|-------------------------|
| Reagents: | Water |
| Dishes: | Glass |
| Tool: | scissors, felt-tip pens |
| Consumables: | paper napkin, rope |

Experimental stages:

1. Cut a strip out of the napkin.
2. Apply colored dots in one row with felt-tip pens.
3. On the string, we also apply several marks at a distance from each other with felt-tip pens of different colors.
4. Pour water into glasses.
5. Dip a strip of paper napkin into the first glass so that it touches the surface of the water slightly.
6. Place the string in the second glass of water in the same way as the napkin.

all experiments are educational in nature, despite the use in them, often of simple everyday objects, for example, experiments with atmospheric pressure, cold and hot water, soda, etc. They never cease to be scientific and at the same time interesting and entertaining.

Conclusion

In conclusion, we can say that demonstrations, practical work, and laboratory work play a key role in the teaching and mastery of physics course topics. Above mentioned techniques, experiments can be used by teachers in teaching subject physics in organizing students' independent work in groups and individually, using modern information and pedagogical technologies in the educational process.

References

- [1] H.O. Juraev., S.Q. Qahhorov. Modeling of heat-physical processes in solar dryers. Journal of Critical Reviews.–Malaysia, 2020. № 7, ISSUE 17. 9-15 pp.
- [2] Shavkatovich S.F., Baxtiërovna N.Y. Changes occurring in ferromagnets by adding some mixture // Scientific reports of Bukhara State University 4:1 (2020), pp 8-13.
- [3] Rakhmatov I.I. Investigations into kinetics of sun drying of herb greens // Applied solar energy. 31:5 (1995), pp. 61-66.
- [4] 4. Atoeva M.F. Opportunities for teaching the section of electrodynamics based on the technology of training frequency. Innovative technologies in science and education International scientific and practical conference. - Penza, 2017.25 August. - S. 217-219.
- [5] Atoeva M.F. Relationship with other subjects of physics course in secondary special education. Innovative technologies in science and education International scientific and practical conference. - Penza, 2017. August 25. - S. 220-222.
- [6] M.F. Atoeva. Interdisciplinary relations in physics course at specialized secondary education. The Way of Science. – Volgograd, 2016. – №9 (31). – P.22-24.
- [7] H.O. Juraev. Ways of using educational materials on alternative energy sources at natural lessons. European science review. – Austria, 2018. №1-2. –Б. 177-180.
- [8] M.F. Atoeva. The significance of periodicity at teaching physics. The Way of Science. – Volgograd, 2016. – № 10 (32). – P.62-64.
- [9] 9. Atoeva M.F. The effectiveness of teaching electrodynamics based on the technology of periodicity. The Way of Science. - Volgograd, 2016. – № 10 (32). - P.65-66.
- [10] M.F. Atoeva. Use of Periodicity in Teaching Physics. Eastern European Scientific Journal. –Düsseldorf-Germany, 2017. № 4. –P. 35-39.
- [11] M.F. Atoeva. Didactic foundations of inter-media relations in the training of

- university students. International Scientific Journal. *Theoretical & Applied Science*. p-ISSN: 2308-4944 (print) e-ISSN: 2409-0085 (online). Year: 2020 Issue: 06 Volume: 86, P. 124.
- [12] M.F. Atoeva, R. Safarova. Pedagogical integration as a means of forming professionally important qualities among students of a medical university. *Academicia*. ISSN: 2249-7137 Vol. 10, Issue 8, August 2020. Impact Factor: SJIF 2020 = 7.13 ACADEMICIA: An International Multidisciplinary Research Journal
- [13] H.O. Juraev. Ways of Using Educational Materials on Alternative Energy Sources at Physics Lessons. *Eastern European Scientific Journal*. –Düsseldorf, 2017. № 2. –P. 83-86.
- [14] H.O. Juraev. Training Materials for Alternative Energy Sources in Education. *Eastern European Scientific Journal*. –Düsseldorf, 2017. №1. –P. 127-131.
- [15] H.O. Juraev., S.K.Kakhkhorov. Use of alternative energy sources at the natural sciences lessons.
- [16] Atoeva M.F. Frequency of teaching physics. Post-graduate student and applicant. - Moscow, 2010. –№6. - S. 41-43.
- [17] Atoeva M.F., S.K. Kakhkhorov. Frequency as a pedagogical regularity of teaching physics. *Pedagogical sciences*. –Moscow, 2010. –№ 6. - P. 56-59.
- [18] M.F. Atoeva. The problems of preparing students for the use of school physical experiment in the context of specialized education at secondary schools. *European Journal of Research and Reflection in Educational Sciences*, UK, Vol. 8 No. 9, 2020 ISSN 2056-5852. P.164-167.
- [19] M.F. Atoeva. Pedagogical Tests As An Element Of Types Of Pedagogical Technologies. *The American Journal of Applied Sciences*, 2(09), (TAJAS) SJIF-5.276 DOI-10.37547/tajas Volume 2 Issue 9, 19.09.2020. ISSN 2689-09. 92 The USA Journals, USA www.usajournalshub.com/index.php/tajas 164-169. IF.5.2.
- [20] Saidov S.O., Fayzieva Kh. A., Yuldosheva N. B., M.F. Atoeva. The Elements Of Organization Of The Educational Process On The Basis Of New Pedagogical Technologies.
- [21] The American Journal of Applied Sciences, 2(09), (TAJAS) SJIF-5.276 DOI-10.37547/tajas Volume 2 Issue 9, 19.09.2020. ISSN 2689-09. 92 The USA Journals, USA www.usajournalshub.com/index.php/tajas 164-169. IF.5.2. Incheon declaration/Education 2030: Towards inclusive and equitable quality education and lifelong learning for all (World Education Forum, 19-22 may 2015, Incheon, Republic of Korea).