Methodology Of Teaching Subjects of Physics Based on Software Educational Tools

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Abstract
The progress of science and technology in the world shows that physics plays an important role in the development of modern technologies. Physical knowledge is an important component not only of the society as a whole, but also of the modern culture of each person, especially if the further professional activity of a person is related to science, technology and production technology. In particular, in the trend of concrete and natural sciences presented in the Declaration of Inchon and "Education-2030" international education development action program [1], the personal experience gained during the activities carried out in physics-independent education and the skills and qualifications of students in the study of physics are of great importance in their formation as individuals. In our country, priority tasks such as "creating new textbooks and alternative literature, updating material-technical, laboratory and teaching-methodical support on the basis of improved programs for in-depth study of physics in academic lyceums" [2]. The application of software learning tools and problem-based learning technologies in teaching the "Electrodynamics" department of physics is of great importance in teaching students to think positively. Systematic work is being carried out on the use of software tools in teaching physics to students, the use of interactive methods in the educational process to create problem situations, the selection of suitable problems, the creation of educational resources for the implementation of virtual laboratory work, and the improvement of educational and methodological support for practical application.

Keywords: software educational tools, physics, educational content, eaching-methodical support, physics process.

I. Introduction

Increasing the effectiveness of the knowledge acquired by students in academic lyceums is one of the encouraging signs of state development. Efforts to learn the content of education lead to creative approaches and independent learning [5; 9 p.]. Society has always had a high need for progressive thinking pedagogues who meet the demands of the times. The content of the teacher's activity is modernized through scientific achievements and advanced pedagogical experiences, with the introduction of creative development.

Modern information and communication technologies and software are the main source of pedagogical innovations. One of the necessary conditions for improving the content of education is to provide software in education, to create the necessary conditions for the formation and development of electronic information

resources of education, and to increase the opportunities for independent learning for students.

II. Literature review

Specific features of modern variable education are reflected and defined by software [6; 10 pp.]. In the article, these concepts are defined as software tools as a part of modern teaching tools. Their development and effective use is possible only in the conditions of a person's orientation to new educational results necessary for successful activity in an innovative society (or knowledge society) [3; 251 p.].

Observations and analyzes have shown that there are different views on teaching electrodynamics using software tools [7; 13 pp.]. Mastering abstract concepts is not enough to rely on students' concrete intuition. Here it is appropriate to start by posing problems and analyzing classic experiments. If the "Electrodynamics" section of physics is not taught on the basis of software tools, the theoretical knowledge acquired by the students will become irrelevant. The student can only remember and apply it to solving problems. In this case, the basic rules do not play their own role, do not ensure the integrity of knowledge.

III. Analysis

Until now, various issues of improving the teaching of "Electrodynamics" department have been studied from a didactic point of view, they are as follows:

- The material selected for the teaching of electrodynamics must first of all be harmoniously connected with the study of the questions in the program, it should allow to fulfill the educational and educational tasks facing the physics course of the general secondary school.
- In the teaching of electrodynamics, the principle of connecting the knowledge and skills more with practice, more precisely, with life, lies.
- The acquired knowledge of the department helps to implement economic and polytechnic education.
- The material selected for the teaching of the "Electrodynamics" section of physics should be scientifically convincing and meet the pedagogical purpose. It can be used only if the student has a clear idea of the practical necessity of the problems posed in the teaching of the "Electrodynamics" section of physics. For this, the problem should be well thought out and believable.
- The need to take into account the student's age characteristics and theoretical preparation of the selected materials in problem-based teaching of the "Electrodynamics" section of physics [4; 12 p]. The content, volume, and place of the material studying the problem is determined based on the general development of the student.
- The material selected for the problem teaching of the "Electrodynamics" section of physics is the basis for the student's independent and research activities.

The "Electrodynamics" section of physics is taught using software tools as follows:

1. To provide a deep, thorough, comprehensive understanding of the communication and relations of the studied phenomenon or objects.
2. To learn more and more deeply from the abstract to the concrete.
3. In the process of studying educational materials, it is necessary to form the relevant concepts, imaginations, skills and qualifications in students, and on this basis, to develop the independence of

understanding and thinking, creative abilities [10; 18 pp.].

If the student can transform his previous knowledge into a theory and see scientific problems from them, he will have reconstructed his knowledge twice.

In order for students to solve scientific problems, it is necessary to know the previous materials thoroughly, to take them into account in the theoretical knowledge, practical skills and qualifications they will acquire later.

IV. Discussion

The Yenka Electricity and Magnetism program is a program that provides opportunities to create and observe experiments related to electrodynamics and magnetism in the modeling of physical processes. From this program, training is organized through an interactive electronic board, a graphic tablet, and at the same time, you can use a personal computer to perform independent work [9; 5 p.].

This program is one of the most powerful programs for performing tasks such as observing physical phenomena in 3D format, conducting experiments, and modeling processes of various levels of complexity. The possibilities of this program are very wide, below are some examples of models created using the program:

- For a part of the chain, a model of the electrical circuit was created (Pictures 1 and 2) in conveying the knowledge and skills of the Om's Law topic to the listener.

1 Om The resistance of a conductor such that the current flowing through it is 1 A when the voltage across the terminals is 1 V

$I=kU=U/R$ (1)

The graph of the current in the conductor as a function of the voltage is called the volt-ampere characteristic.

$R=\rho l/S;$ (2)

ρ – resistivity, a physical quantity defined by the resistance of a conductor per unit length and unit area.

Relative resistance depends on temperature.

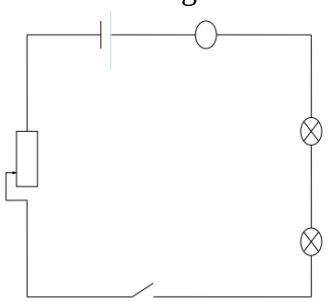
$\rho=\rho_0(1+\alpha t^oc)$

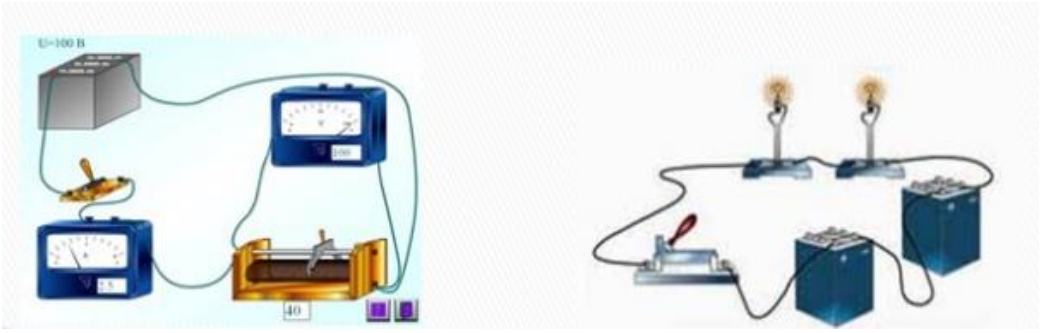
α - temperature coefficient of resistance.

$R=\rho l/S=\rho_0(1+\alpha t)l/S=R(1+\alpha t)$

$R=\rho l/S;$

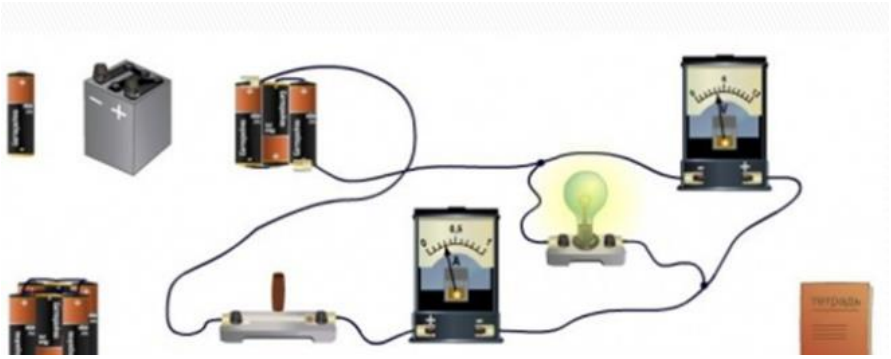
Resistance of a given conductor at 0^oc.





Picture 1. Whether or not there is current in the circuit.

The model in Figure 1 demonstrates the knowledge and skills acquired about the presence or absence of current in an electric circuit, the direction of electric current, and the series and parallel connection of conductors.



Picture 2. The current in different parts of an electric circuit is directly proportional to the voltage in that part.

Picture 2 shows that the current in different parts of the electric circuit is directly proportional to the voltage in that part. The Yenka Electricity and Magnetism optima program can calculate the values of the physical quantities available in the experiment with great accuracy along with the modeling of physical processes on the computer, the correlation between the physical quantities creates graphs, save the developed models and print them in a paper version.

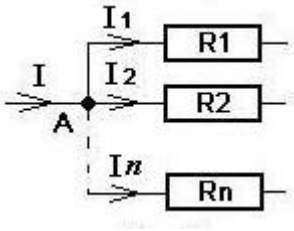
Yenka's Electricity and Magnetism optima program has revolutionized the teaching of physics course topics.

- The Crocodile Technology program also provides opportunities to use modern information technologies in mastering the subjects of the physics course, especially in studying the Electrodynamics department [6; 6 p.]. It is also effective in making models of electrical engineering course topics, especially those related to electrical circuits. In the program Crocodile Technology, we show the models developed for passing the topic of Kirchhoff's laws (Pic. 3, Pic. 4).

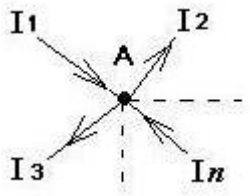
Kirchhoff's first law

• The algebraic sum of the currents arriving at the node of the electric circuit is equal to the algebraic sum of the currents leaving the node, and the resulting current value at this point is zero:

$$\sum_{i=1}^{n} I_i = 0$$



Picture 3. Kirchhoff's first law.

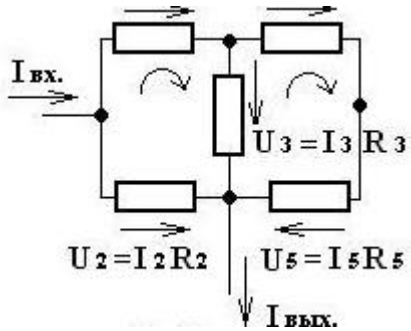


Picture 4. Kirchhoff's second law.

• the algebraic sum of the currents in the parts of the arbitrary closed circuit of the branched electric circuit, multiplied by the corresponding resistances, is equal to the algebraic sum of the EUKs in this circuit:

$$\sum_{i=1}^{n} Ei = \sum_{i=1}^{m} Ui = \sum_{i=1}^{m} Ri^{*}Ii$$

$$U_1 = I_1 R_1 \quad U_4 = I_4 R_4$$



Picture 5. Calculation of current forces in arbitrary closed circuit parts of a branched electric circuit.

In our example, it can be expressed as follows:

$U_1+U_3-U_2=0$

$U_4+U_5-U_3=0$

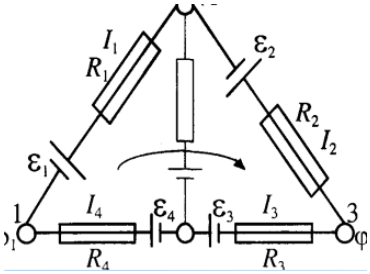
also according to Kirchhoff's first law:

$I_{вх} -I_1 -I_2 =0$

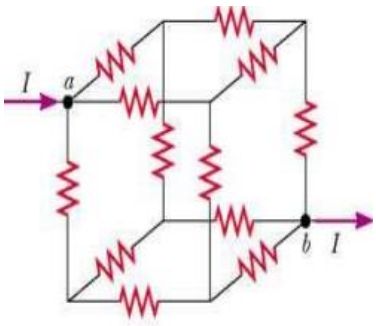
$I_1 -I_3 -I_4=0$

$I_4 -I_5=0$

$I_2 + I_3 + I_5 - I_{вых}=0,$



Picture 6. Electrical scheme.



Picture 7. The process of assembling electrical circuits based on software training tools.

The program is an electronic designer that allows you to simulate the process of assembling electrical circuits on the monitor screen, as in real experiments, and measure electrical quantities with a multimeter (3-dimensional), ammeter and voltmeter.

The introduction of elements of problem-based educational technologies in the course of using software educational tools further increases the efficiency of mastering the topics of the Department of Electrodynamics. The technology of problem-based education serves to form students' skills in finding the most optimal options for the approach to the study of electrical phenomena by analyzing a specific, real or artificially created problem situation in the department. It teaches students to study and analyze any meaningful situation directly related to the Department of Electrodynamics.

We can identify the following as the main elements in studying Electrodynamics from problem-based learning:

- education (formation of knowledge, skills and abilities on electrical phenomena);
- management (management of the process of solving the problem set before the student);
- problem solving (finding ways to find a solution to a given problem);
- gathering information (remembering all the necessary knowledge and skills to solve the given problem situation);
- study them (study and scientific analysis of collected data). The indicated elements, as well as the form, methods, tools and educational results of the educational communication between the teacher and the student are listed.

The possibility of using the problem situation method:

- develops students' interest in mastering the Electrodynamics department, practical skills, creative thinking skills for analyzing the situation and making the right decision;
- creates an opportunity for them to actively acquire knowledge based on various problem situations and their solution [8; 21 pp.].

Skills and competencies that can be

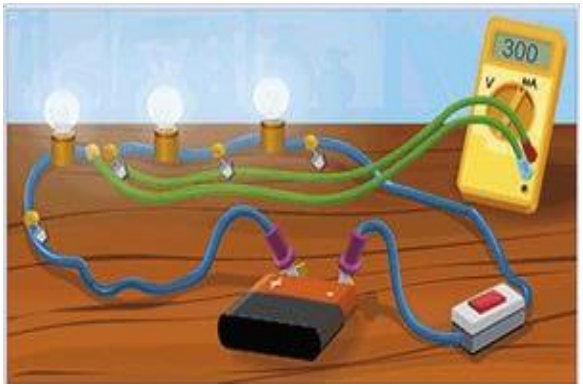
developed by creating a problem situation:
1. Analytical skills (qualifications).
2. Practical skills (qualifications).
3. Creative skills (qualifications).
4. Communication skills (qualifications).
5. Social skills (qualifications).
6. Self-analysis skills (qualifications).

If the problem situation is a question-situation, then several questions are presented regarding the analysis and solution of the problem or problem situation. For example: 1. To find the Coulomb force in determining the force of interaction between charged point charges, the scientist used the model of the experiment to find the force of gravitational interaction in his experiments. How true do you think this idea is?

2. The type of electric field depends on the type of charge that creates the field. Is this idea correct?

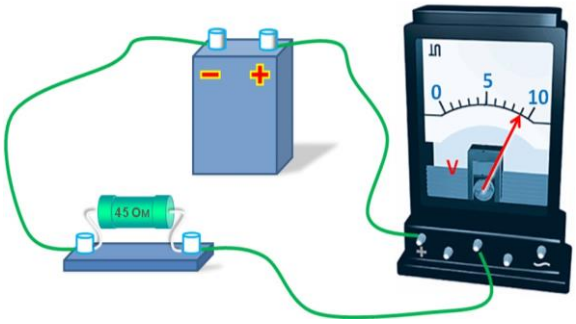
If the problem is a task-problem, then tasks that need to be performed in the process of solving the problem are given. For example:

1. Draw and explain the circuit diagram shown in Picture 8:



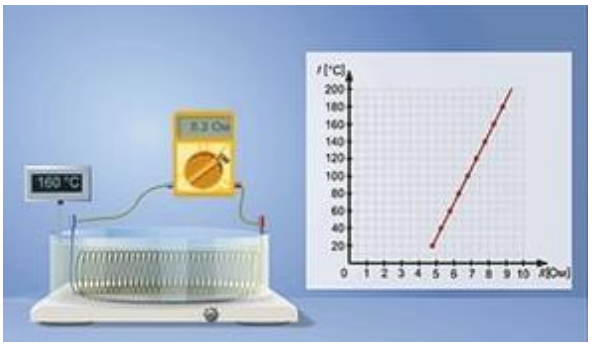
Picture 8. Circuit diagram.

Draw the circuit diagram shown in Picture 2. 9 and calculate the electric current.



Picture 9. Electric circuit diagram.

Explain the essence of the experiment shown in Picture 3. 10, write and interpret the temperature dependence formula of the conductor resistance. Explain the graph.



Picture 10. Experience and graphics.

The following instructions should be followed when organizing lessons in which a problematic situation is created:

1. The teacher should thoroughly study the problem he plans to put before the student and determine the solution to the problem in advance.
2. It is necessary to assess the urgency of the problem.
3. The urgency of the problem should be explained with the help of evidence.
4. It is necessary to determine ways to effectively solve the problem.
5. It is necessary to choose methods and technologies that determine the effective solution of the problem.
6. It is necessary to form hypotheses (scientific hypotheses) that guarantee an effective solution to the problem.

V. Conclusion

In conclusion, any software is required to perform certain actions. They can be flexible and adjustable or fixed - depending on the needs of the future owner, the system can be adapted to the requirements, versatile - suitable for a wide range of different tasks, Complete - filling the algorithm, no other utilities are required after the cycle is completed. Problem-oriented - there is a solution to a problem in a specific subject area that needs to be solved using any available software.

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