



IMPROVING THE METHODOLOGY OF TEACHING PHYSICS IN SCHOOL EDUCATION USING VISUAL MODELING

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Abstract: This article considers the improvement of the methodology of teaching physics in school education using visual modeling, as well as their productive influence on the lesson of physics in general schools in our country and even in the world.

Keywords: physics, visual modeling, methodology, school education system, pupils, lesson, teaching.

We all know that physics is an experimental science. And a visual demonstration of physical phenomena or processes in the classroom is the basis of teaching physics at school. It contributes to the creation of physical thinking in pupils, makes the teacher's explanations more understandable when presenting new material, awakens pupils' cognitive interest in the subject.

It is not always possible to demonstrate physical processes or conduct experiments in a school laboratory. The reasons for this may be different:

- lack of necessary equipment;
- the danger of conducting the experiment under given conditions;
- the impossibility of conducting a demonstration in real conditions.

Of course, it is possible to explain a physical phenomenon from pictures or “on the fingers”, but will there be a result from this? How correctly will the pupils present this or that phenomenon? To understand a physical phenomenon, and then be able to explain it, it is necessary to visualize it. The visual representation of a physical phenomenon or process allows the pupil to better remember and study it. That is why every physics lesson should have a demonstration, a visual representation of physical phenomena. And if it is impossible to do it under the given conditions, then you need to use a computer demonstration. And I would add - you need to use it!

Using a computer, it is possible to create not only static models of physical phenomena in the form of illustrations, but also dynamic models. And it is most effective to use interactive computer models in the educational process, which allow you to slow down or speed up the passage of time, increase or decrease, repeat or change the situation. Interactive computer models used in individual work, for example, in the 1 pupils - 1 computer model, allow each pupils to explore a physical phenomenon at their own pace. When a computer model is controlled by a teacher on an interactive whiteboard, the pupil simply passively observes, while each pupil has his own speed of perception. But when pupils manage the computer model on their own, this will already increase the degree of assimilation of the received educational information and increase cognitive activity.

Scientific observations, analysis of the results of pupil work show that the main problem in studying the subject "Physics" is the difficulty associated with solving problems. The main reasons for the mistakes made by pupils in solving are difficulties in the primary perception of the problem,

difficulties in determining the conditions and requirements of the problem, their correlation, i.e., in the inability to analyze the task, to determine the indicative basis of actions [1]. For this reason, most pupils begin to consider physics a very difficult subject and lose interest in the lesson and the subject.

Therefore, it remains relevant to search for common approaches, methods for teaching pupils a whole class of tasks.

The use of computer simulation integrates didactic capabilities in teaching problem solving and is a method for developing the mental abilities of pupils [2]. And the introduction of new educational technologies in the educational process allows using modeling along with traditional methods of solving problems.

In the school physics course, pupils study some models, but do not realize their true essence: they study them simply as a phenomenon, numbers, geometric shapes, do not combine them with the general concept of “model” or “modeling”. The problem of teaching modeling in solving computational problems, in our opinion, remains relevant and requires development [3]. Therefore, the purpose of our work was to develop and apply the method of modeling computational problems for the development of mental and creative abilities of pupils and teaching the skills of modeling and solving this type of problems.

A physical problem in educational practice is usually called a small problem that is solved with the help of logical conclusions, mathematical operations and an experiment based on the laws and methods of physics. From this definition it follows that the complexity of solving a problem arises for two reasons:

- a) insufficient knowledge of the laws and definitions of physics, formulas, mathematical expressions, etc.;
- b) taking into account the individual characteristics of pupils, which consist of the ability to analyze, memorize, present and build logical conclusions, consistently building the course of solving a problem.

The system of visual modeling and problem solving with the help of the inherent algorithmic approach and formalization of the task representation allows at each moment of time to provide an approximate base of actions for each pupil individually, which is almost impossible to do with the traditional approach to problem solving. The development of creative potential is formed due to the interface and openness of the program for the user, i.e. the teacher can create his own bank of tasks when planning a lesson, change the parameters and variables of tasks, add formulas without having knowledge in the field of programming, build an individual learning path for each pupil. The general view of the working window of the program is made in the form of a set of editors, panels and layers (Fig. 1).

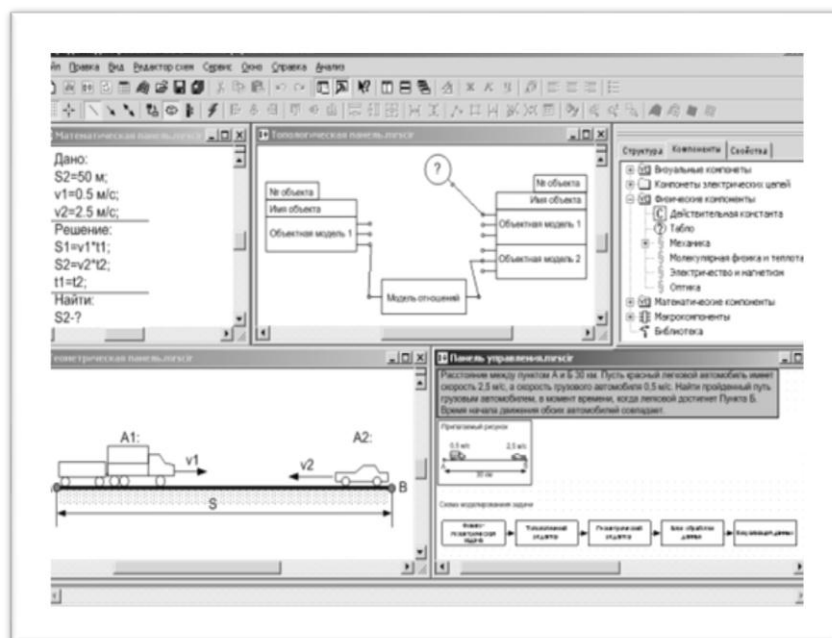
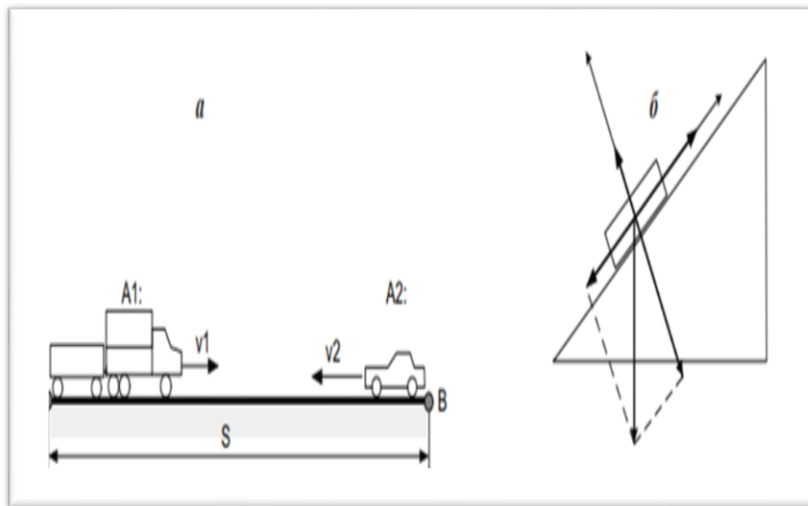


Fig. 1. General view of the program window

Using these tools allows you to build the structure of the solution of the problem in the form of a component chain.

The primary perception and analysis of the selected text of the task by the teacher or pupil begins with the control panel (Fig. 1, lower right corner). One of the main goals of analysis is to determine the object (or system) that is considered in the problem, to establish its initial and final state, as well as the phenomenon or process that transfers it from one state to another, to find out the reasons for the



change in state and to determine the type of interaction of the object with others. objects (this helps to explain the physical situation described in the condition and give it a visual representation in the form of a picture) [4]Next, work is carried out with the geometric panel, which allows you to draw a drawing using a ready-made set of geometric primitives, i.e. the objects directly involved in the task are distinguished in the form of geometric figures (Fig. 2, a, b), the necessary vector and scalar quantities are indicated.

Fig. 2. Examples of construction on the geometric panel:

a - a problem with cars; *b* - bar on the plane.

The implementation of the task solution plan takes place directly on the topological panel. Using the proposed library of component models - BMK, in which you can make changes: add formulas, mathematical expressions, subsections of physics, a model is compared to the selected object, taking into account its parameters and variables, i.e. its physical formula. The conversion of physical quantities into the SI system is carried out, the constants and the required quantities of the problem are compared.

Next, a connection is established between the variables of objects, for example, variables - x_1 , x_2 , 11 , 1 (Fig. 3). By selecting the "Mathematics" folder in the BMC, the variables are defined, in this case using the equality $x_1 = x_2$, $11 = 12$. If the variables of the objects are equal, you cannot write an expression by connecting the variables to each other, for example $x_1 = x_2$.

Fig. 3. Topological panel

After pressing the "calculation" button, the list model of the chain is formed, which is solved using the SM MARS computational core. The problem will not be solved if not all variables are defined. To see the overall picture of all used formulas of the problem and mathematical records, the mathematical panel is used [5]. Here, the formula solution is automatically written, which appears in the topological editor (Fig. 4).

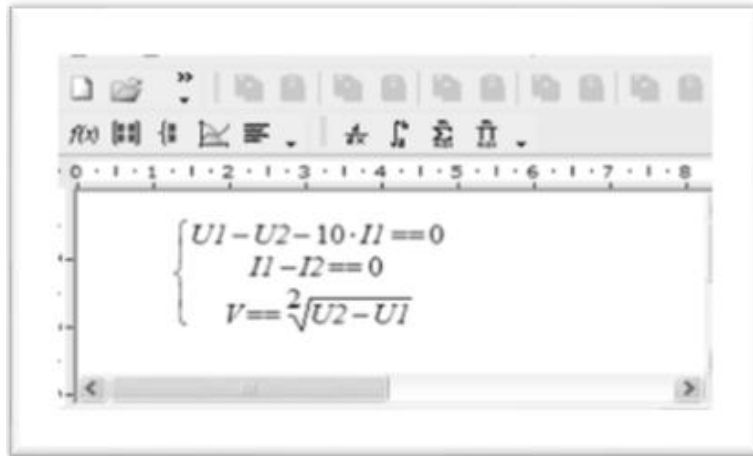


Fig. 4. Math panel

For the purpose of associativity of actions and drawing an analogy, the mathematical panel allows you to represent the form of writing the problem adopted in physics lessons, and combine all the elements of the problem shown on the topological panel into one whole. Thus, all forms of perception by the pupil of information from the monitor screen are taken into account.

The search and display of mathematical errors is assigned to the calculation system "Macrocalculator". At the moment, the developers of the mathematical system have implemented more than 120 handlers of the error control module [3]. For example: Syntactic - when typing formulas (inconsistency with mathematical notations, rules, typos...). Computational - when calculating the result (dividing by zero, no root.). Including errors in introducing inappropriate dimensions of physical quantities, etc. In all of the listed SWIMS editors, it is possible to switch from one editor to another in order to determine the missing elements.

In addition, the presence of a visual panel allows you to visually see the results of solving the problem.

The objects participating in the geometric panel, depending on the initial and received data, carry out a behavioral character. By changing the parameters of the problem, it is possible to trace the change in the behavior of objects and determine the possible dependences of physical quantities, combining the solution of the problem with the experiment, which corresponds to a greater understanding of the problem.

By properly organizing classes at school or independently solving problems, one can gradually master the technology for solving physical problems. It has been noted that the more detailed the model of mental and practical operations performed in solving a particular problem is thought out and presented, the more successful the training is [2]. Since it is most often carried out by obtaining answers to a logical set of questions following one after another, over time, pupils will learn to correctly formulate questions, mentally asking them to themselves and thus penetrating into the physical essence of the tasks, and this is the main condition for their successful solution.

At the end of the article, I would like to say about software products that are common in the market of educational technologies and, at first glance, have some common features with SWIMZ - these are "Live Physics" and "Borevsky's tutor". "Live Physics" allows you to simulate and visualize the problems of dynamics using geometric primitives. In a visual modeling and problem-solving system, these functions are handled by a geometric panel that can visualize any quantitative problem that requires drawing. In Borevsky's tutor, one can note an approach to solving problems that contains 4 levels of solution control and visualization; unfortunately, this is a closed program consisting of a limited bank of tasks. SWIMZ is open to the user, it allows the pupil to simulate the tasks given at home by the teacher, to independently learn modeling and solving physics problems, and the teacher, depending on the learning goals, organize the lesson. The versatility and flexibility of use prioritizes the program in such a way that the program takes into account the individual learning goals of the pupil and teacher. Today, software products that are closed, i.e., contain a ready-made set of tasks,

theory, laboratory work, demonstrations, which does not always coincide with the methods of teaching physics.

Programs that allow you to achieve openness for the user, as a rule, require knowledge of programming languages - Pascal, C, Delphi, etc. or numerical methods - Mathad, Excel, which additionally loads the educational process and reduces the tasks of physics to the study of additional programming subjects and numerical methods.

References

1. Bayandin D.V. Teaching physics based on modeling computer systems. - Moscow: School technologies, 2021.
2. Dmitriev V.M. "Method of multispectral analysis as an algorithm for formalizing problems in physics," Vestnik Moscow mountains ped. university 2021.
3. Kovaleva S.Y. Improving the mutual understanding of teachers and pupils // Physics at school. 2020.
4. Volodarsky V.E. Teaching schoolchildren problem solving // Physics at school. 2020.
5. Zelichenko V.M., Dmitriev V.M., Sharova O.N., and Filippov A.Y. "Solving problems of physics using a system of visual modeling and problem solving (swims)" Bulletin of the Tomsk State Pedagogical University, 2021.