

Studying physics lessons in the system of exact sciences using digital technologies and online games

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Abstract: The problem of using gaming technologies for teaching schoolchildren to solve physical problems is discussed. Studying physics lessons in the system of exact sciences using digital technologies. The possibilities of a virtual environment for organizing gaming learning activities are considered. The analysis of the domestic and foreign gaming resources in physics presented in the open access is given. The necessity of replenishing the modern resource base of this type, including the section of computer games for training sessions on solving physical problems, is substantiated. The didactic game "Golf" developed by the authors of the article is presented. The game model of the resource is implemented in the 3D simulation mode in the Unity environment. The content of training tasks, dynamic game video sequence, the interactive nature of the interaction of participants with game objects and the competitive effect of the game are aimed at consolidating and developing the knowledge, skills and abilities previously acquired by the student in solving physical problems on the topic "Kinematics".

Keywords: teaching physics, exact sciences, solving physical problems, game learning technologies, virtual game environment, development of digital game, learning resources in physics.

Problem solving is one of the important ways for students to acquire scientific knowledge and develop their cognitive skills. This type of activity contributes to the development of thinking and creative abilities of students, influences the formation of their interest in the study of physics.

To date, a very extensive system of scientific and methodological knowledge and effective pedagogical practices for teaching students to solve problems in physics have been accumulated. This serves as a sufficient basis for comprehending and transferring the accumulated pedagogical experience to a new information and educational environment, saturated with virtual educational objects and computer learning technologies.



The implementation of productive technologies for teaching students to solve physical problems by means of a virtual information environment is an urgent problem of modern methodological science and pedagogical practice. Works devoted to finding ways to solve this problem have already been presented in the pedagogical press (D.V. Bayandin, M.D. Dammer, V.A. Izvozchikov, A.S. Kondratiev, V.V. Laptev, A.A. Ospennikov, E.V. Ospennikova, V.G. Petrosyan, L.V. Petrosyan, I.R. Perepecha, S.E. Popov, L.A. Proyanenkova, A.V. Smirnov, M.I. Starovikov, D.E. Temnov, A.O. Chefranova and others). The process of accumulating digital resources intended to support the educational process in solving physical problems is gaining momentum. These are resources on CD and resources of the global network.

Digital manuals on CD for high school, distributed in the domestic market, contain a large number of educational tasks. The practice of developing such resources has more than two decades. In recent years, the quality of these resources has changed for the better. The species composition of tasks has been updated, in particular, the number of tasks of different levels of complexity (tasks-exercises, typical, non-standard) has increased, more attention is paid to contextual physical tasks and tasks-projects for educational research. The variety of media formats for representing problem situations is growing. A wide range of virtual objects (video drawings, animations, models, simulators, etc.) are involved, which can be used not only to present students with problem situations, but also to support the process of solving a problem, as well as to check the result. Computer technologies for the formation of students' skills and abilities in solving problems are being improved: the variety of interactive exercises for practicing individual operations necessary for solving problems of various types has increased; original simulators have been developed for mastering the basic actions that make up the solution of a physical problem; the help system has been updated and expanded, which provides examples of solutions to problems of varying complexity; Interactive training tests appeared, designed for self-control by students of the level of formation of their skills and abilities in solving problems.

In addition to resources on CD, an Internet database of digital materials for solving problems has been created and is being developed. There is a whole network of educational portals and sites (federal, regional, regional and personal), which present: collections of problems of various types, digital solution books and

reference books, tool programs for solving problems, simulators and tests, video tutorials for solving problems on various educational topics, distance schools (courses) to prepare students for the Unified State Examination, workshops for applicants, materials for physics olympiads, materials for physics teachers on the methodology of teaching students to solve problems, etc. Enough the developed digital resource base creates all the necessary conditions for a significant update of the practice of organizing the educational process to solve physical problems in order to increase its effectiveness. The purpose and role of the task in learning is determined by its essence as a pedagogical tool. In accordance with the concept of A.N. The Leontief task is considered as a component of the subject's activity (a relatively independent formation in the structure of this activity): "... the goal of the action, set in certain conditions" [7]. In a more complete interpretation, the essence of this concept is defined as follows: "The task is the result of reflecting in the consciousness of the subject the situation of life activity, which requires mental and practical actions from him, aimed at its transformation, taking into account the goals relevant to the subject and objectively specified (internal, external) conditions for this transformation" [8, p. 481]. Note that task situations can be fixed not only in the individual, but also in the public consciousness. Objectified by a person and presented on an auxiliary medium, the task becomes the property of society and can be both relevant and irrelevant for society.

An educational physical task is a task for the solution of which knowledge of the basics of physical science is used and methods of cognition corresponding to this science are applied. The educational nature of the task is determined by the orientation of its content and methods of solution to the mastering by students of the system of subject and meta-subject knowledge, skills and abilities (KAS), as well as the development of a system of psychological properties (in particular, methods of mental actions - SUD) and personality traits of the student [8].

The following are the educational functions of the learning task:

- educational:

- assimilation of knowledge (about facts, concepts, laws, theories, methods of activity);
- improving the quality of knowledge (depth, strength, consistency, etc.);
- comprehension of interdisciplinary connections of various fields of science and practice;

- mastering the methods of natural science knowledge;
- formation of cognitive and practical skills;
- developing:
 - improvement of the entire system of cognitive processes (attention, perception, representation, imagination, thinking, memory, speech);
 - formation of readiness for creative activity;
- educational:
 - formation of scientific outlook and natural-science style of thinking;
 - formation of socially valuable motives for learning (in particular, cognitive interest);
 - formation of individual independence in learning;
 - education of volitional and moral qualities of a person;
 - Assistance in the formation of the general culture of the student and his readiness to apply knowledge in solving various problems of life.

One of the important conditions for the implementation of broad educational opportunities inherent in the activity of solving problems is their necessary and sufficient diversity. Classifications of learning tasks are given in [8, 10]. The construction of these classifications is based on ideas about the variety of types of educational activities, including the activities of students in a virtual educational environment. The authors identify more than 15 classification grounds. According to the content of the activity, they distinguish: scientific tasks (to be solved together with a teacher, a scientific consultant: the concept of V.V. Mayer); learning tasks and game learning tasks.

Within the framework of this article, questions of the development and application of game situations in solving physical problems are considered.

Game tasks are quite an effective means of learning. Game development (proposing an idea, preparing a script, producing game objects) based on educational tasks is a fairly obvious and very effective methodological activity, since almost any game situation is associated with a person solving certain problems.

The game is the resolution of any situation of human life in a conditionally modified environment. A person agrees on the content of the changes to be made with the participants in the game or with himself. Changes are both ideal and material. Material changes are associated with the use of special game objects. The laws of interaction of an individual with game objects, regardless of the environment

(nature, "second" nature, book, audio and video, virtual environment), to which they belong, are of a general nature.

Game activity necessarily has as its result a pronounced complex educational effect: training, development and education. The acquisition of new experience in the game (learning) is its important goal, but, in addition, the game is a significant means of satisfying the needs of the emotional-sensory sphere of a person, his needs for self-affirmation, self-realization, and communication. Game activity contributes to the development of the volitional beginning of a person's personality, his intellectual and physical abilities, etc. The presence of the second (personal) component of play activity makes learning in play involuntary, emotionally comfortable, and highly productive (although the effect is usually achieved in a fairly narrow area of social practice).

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