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SCIENCE LITERACY IN PHYSICS LESSONS

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Abstract:
The article is devoted to the problem of developing students' scientific literacy in teaching physics at school. A set of competencies is proposed, where special attention is paid to developing students' functional literacy and interest in the natural sciences, and through it - physics.

Keywords: Functional literacy, PISA research, set of competencies, scientific literacy, solving problems on scientific literacy, independent practical activity.

ЕСТЕСТВЕННОНАУЧНАЯ ГРАМОТНОСТЬ НА УРОКАХ ФИЗИКИ

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Аннотация:
Статья посвящена проблеме формирования у обучающихся естественнонаучной грамотности в преподавании физики в школе. Предлагается набор компетенций, где особое внимание уделяется формированию функциональной грамотности учащихся и интереса к естественным наукам, а через него - физике.

Ключевые слова: Функциональная грамотность, PISA исследования, набор компетенций, естественнонаучная грамотность, решения задач на естественнонаучную грамотность, самостоятельная практическая деятельность.

Introduction

It is known that in order for a child to become functionally literate, it is necessary to develop him in five areas: reading literacy, mathematical literacy, financial literacy, natural science literacy and creative thinking. All areas of functional literacy are in each subject.

Applying it to physics, we can say that financial literacy is very far from the subject. But nevertheless, in order to calculate the energy consumed by our electric meters, we can also consider the problems in the lesson - this will be financial literacy. In physics lessons, you can't do without creative thinking. Many problems are about mechanisms and technology, so it is impossible to solve them without an understanding of physics. Reading literacy is an aspect that cannot be done without. Any tasks are solved correctly only with proper reading and interpretation.

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Mathematical literacy is also present in physics, but not in the same context as in mathematics. But we focus on our engine - this is natural science literacy. In order to find out how it works, it is necessary to prepare a small platform. Having analyzed the tasks, we can come to the conclusion that they are all aimed at developing functional literacy, because they achieve meta-subject learning outcomes. If we look at the tasks, we can highlight tasks for working with text, support tasks, contextual tasks, qualitative tasks, tasks for physical research, work with information in non-text form (picture, graph, diagram). What equipment does the teacher have? These are textbooks, problem books, workbooks, collections of tests and independent work, technological maps of lessons, methodological recommendations. What competencies are tested for natural science literacy? This is a scientific explanation of phenomena, understanding the features of natural science research, interpreting data and using scientific evidence to draw conclusions.

In order for a student to have a set of competencies, it is necessary that he or she be able to:

1) apply relevant natural science knowledge to explain a phenomenon; recognize, use and create explanatory models and ideas; make and justify forecasts about the course of a process or phenomenon; explain the operating principles of technical devices or technologies;

2) recognize and formulate the purpose of this study; propose or evaluate a method of scientific research of this issue; put forward explanatory hypotheses and propose methods used by scientists to ensure the reliability of data and the validity of explanations;

3) analyze, interpret data and draw appropriate conclusions; transform one form of data into another; recognize assumptions, evidence and reasoning in scientific texts; evaluate arguments and evidence from various sources from a scientific point of view.

Let's consider the application of the first competence - scientific explanation of phenomena. What can we offer the student? It is necessary to offer a description of a standard situation for which we can directly use the program material. What tasks can be offered to develop this skill? For example, a standard task to find the average speed of a body, where students will be able to apply their knowledge on the topic.

The second skill of scientific explanation of a phenomenon is to recognize, use and create explanatory models and representations. Here you can apply descriptions of a non-standard situation for which there is no ready-made explanation. To obtain an explanation, it must be transformed into a standard model. For example, to come up with a block structure that provides a 4-fold gain in force, …

The third skill is to make scientifically sound predictions about the course of a process or phenomenon. For example, you can offer to explain the further development of a situation based on some phenomenon. For example, get an answer to the question: why does a person fall backwards when he slips, and forward when he trips?

The fourth skill is the ability to explain the operating principle of a technical device or technology. For example, the model of an atom or Newton's balls, …

The second competence is understanding the features of natural science research (recognize and formulate the purpose of the research):

1) determine the purpose of the research based on the description of the research (for example, a drawing with measuring cups of water of varying degrees of diffusion);

2) briefly formulate the idea of the research or describe all stages of the research based on the description of the problem (an example with a heated ball passing through a ring);

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3) put forward hypotheses and suggest ways to test them (a hypothesis about the structure of all substances from tiny particles and the decrease in their volume over time);
4) describe and evaluate methods that ensure the reliability of the result. It is best to conduct experimental laboratory work (calibration of a dynamometer or Faraday's experiment on electromagnetic induction, ...)
Let's consider all this using the example of the lesson "Diffusion. Brownian motion". When preparing for the lesson, we need to consider what skills from natural science literacy we will practice and what tasks need to be selected.
At the stage of studying new material, we describe Brown's experiment. We create a problem situation: why do spores move chaotically? Here, the competence of scientific research of this issue is offered. Next, we can consider the following experiment: a solution of copper sulfate is poured into a glass vessel, and water is very carefully poured on top. Question: what can be learned using this experiment? When answering questions about the experiment, we recognize and formulate the purpose of this study. Based on this experimental material, you can give the task of drawing a model of particle motion, completing which, the student transforms one form of data presentation into another. When explaining, we talk about the hypothesis that diffusion can occur in gases, liquids, and solids. You can offer a task to test this hypothesis. This is another skill from the competence. Speaking about the rate of diffusion, you can give a task to give examples of an increase in human body temperature with the participation of diffusion. Here, you can also consider the competence of scientific justification of the forecast for the course of the process. The experience is described, it can be considered and practiced.
At the consolidation stage, you can give a text or a series of questions, which again include such competencies as the use of natural science literacy to explain the phenomenon. As a homework assignment, you can give questions after the topic or tasks from problem books. If we summarize the lesson, we can say that about ten competencies out of twelve were touched upon, and this is if the class is strong. We will not be able to form such a number of competencies in each lesson and there are the following factors for this:
1) the work in the lesson is based on the subject content, so the main emphasis is on the subject result;
2) each physics lesson has its own set of competencies;
3) only 3-5 types of competency-based skills can be developed in a lesson;
4) it is impossible to review PISA assignments during a lesson, since time is limited;
5) PISA assignments can be taken element by element (2 out of 6 or 1 out of 5) in a lesson.
The Programme for International Student Assessment (PISA) has summed up the results of testing in mathematics, reading and natural sciences among 15-year-old schoolchildren in the countries of the Organization for Economic Cooperation and Development (OECD). The worst situation in the Republic of Uzbekistan is with scientific literacy. According to this indicator, the country scored 336 points, 149 points less than the OECD average. Only 19% of test takers were able to give a correct explanation of scientific phenomena and use this knowledge to determine the validity of conclusions using simple examples. In the OECD, the average was 76%. The first results of the PISA study of the education system of Uzbekistan will serve as a very important factor for our further steps in achieving our goals. Our goal is that we have done everything possible to overcome these shortcomings. To do this, we rely on the knowledge and potential of

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our qualified and hard-working mentors.

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