GENERALIZATION AND SYSTEMATIZATION OF KNOWLEDGE OF STUDENTS IN PHYSICS

[1]Kakhor Shonazarovich Tursunov & [1]Aktam Xusenovich Raximov
[1]Candidate of Pedagogical Sciences, Associate Professor, Department of Physics, Karshi Engineering and Economics Institute, **UZBEKISTAN**

ABSTRACT

In the article, the use of systematization not only organizes a person's knowledge about objects of knowledge, but also serves as a source of new knowledge. The selection of training material is based on the system: a number of phenomena are studied that are interconnected, and at the same time, taking into account the principle of "from simple to complex". In each section, educational information is systematized around core concepts.

Keywords: Principle, systematization, analysis and synthesis, comparison and classification, scientific facts, concepts, laws, theories, physical quantities, physical picture of the world, information, generalizations, body, substance, field, interaction, energy.

INTRODUCTION

The tasks of teaching physics are the formation in students of deep, strong and effective knowledge, the basics of physics and their practical applications, knowledge of the methods of natural science knowledge and the structure of scientific knowledge, the development of their thinking, etc. One of the ways to solve these problems is to organize special work to generalize and systematize knowledge.

By systematization is understood mental activity, in the process of which the studied objects are organized into a certain system based on the selected principle [1].

When systematizing, such mental operations as analysis and synthesis, comparison and classification are carried out, during which students distinguish the similarities and differences between objects and phenomena, group them in accordance with the chosen signs or grounds, establish causal relationships, essential relationships between objects and phenomena. In the process of systematizing knowledge, not only semantic, causal, but also structural relationships are established, in particular, relationships between the components of the structure of the elements of physical knowledge: relationships within physical concepts, laws, theories, and pictures of the world. In this case, the problem of the formation of systematic knowledge of students is solved.

Psychologists note that students' knowledge is deeper and stronger if they have been systematized and generalized. Systematization allows the use of memory, since it frees it from the need to memorize material as the sum of private information and facts by grouping them into larger units. The mechanism of perception of information by a person is connected with the activity of systematization: when perceiving new information, we compare it with already known knowledge (association), we try to group new information.

MATERIALS AND METHODS

The use of systematization not only organizes the knowledge of a person about objects of knowledge, but also serves as a source of new knowledge. The teacher should introduce students to systematization techniques so that they can apply them on their own. Systematicity is such a quality of knowledge that is characterized in the student's mind by the presence of logical connections between the components of the phenomena being studied. The selection of training material is based on the system: a number of phenomena are studied that are interconnected, and at the same time, taking into account the principle of "from simple to complex". In each section, educational information is systematized around core concepts. For example, in mechanics — point, body, substance, field, interaction, energy.

The methodological basis for the systematization of students' knowledge is the systematic approach adopted in science - a methodological tool for studying integrated objects and integral dependencies and interactions, which allows, on the one hand, to give a general idea of the process, phenomenon, object, and on the other hand, to see their components, connections between them, the place of a given system as part of another, more complex [2].

An objective scientific basis for the systematization of students' knowledge is the features of physical science and physics - an educational subject that is distinguished by its logical harmony, both of scientific knowledge itself and of its formation.

The didactic basis for the systematization of students' knowledge is the patterns of assimilation by students of knowledge and methods of activity, reflected in the principle of systematic and consistent learning, as well as in the principle of systematicity.

The psychological basis for the systematization of student knowledge is the formation of associative connections: local, part-system, intrasystem and intersystem. In the first three cases, systematization is mainly of an intra-subject character; in the fourth - interdisciplinary. Accordingly, several objects of systematization of knowledge in physics can be distinguished:

–Scientific facts (phenomena, processes);
–Physical concepts, including physical quantities;
–Physical laws;
–Physical theories;
–General scientific methodological principles;
–Physical picture of the world [1].

In addition, knowledge can be systematized on the basis of some core ideas of the course, in particular, it is advisable to systematize applied knowledge in accordance with the main directions of scientific and technological progress, worldview and methodological knowledge in accordance with the cycle of scientific knowledge or on the basis of philosophical categories of matter, movements, space-time, interactions, ideas about which develop as you study the course.

In the case of systematization of knowledge at the interdisciplinary level, we should talk about general natural science concepts, laws, theories, and the picture of the world [3].

The object of systematization depends on the stage at which the course of physics is studied. So, at the end of the study, topics systematize knowledge of physical phenomena, concepts, quantities and laws; at the end of the study of sections - on physical theories; at the end of the

course, on the physical picture of the world; Before submitting new material, it is important to summarize what was learned in past lessons.

The didactic role of systematizing knowledge lies in the fact that combining knowledge about facts, phenomena, laws, and principles into a system allows us to discover new connections unknown to students and the relationships between them, to make generalizations of a world outlook character and turn systematization into a means of cognition. The level of formation of the knowledge system among students is an important indicator of their intellectual development; it determines the ability of students to cope with new cognitive tasks, rebuild knowledge, and include them in new systems, i.e. serves as an indicator of the ability of students to carry out creative activities. In the process of systematization, students' attention and activities are aimed at highlighting the main thing, at combining many isolated facts into groups, which allows you to organize knowledge, unload memory, more fully capture and comprehend information. At the same time, a generalization of students' knowledge often occurs, consisting in the mental unification of objects and phenomena that are similar in some ways. Generalization involves an initial study of objects, the allocation of the general and the special in them, their unification into groups according to selected characteristics, division into types, etc.

The generalization of knowledge is the transition to a higher level of abstraction by highlighting common signs (properties, relationships, relationships, etc.) of objects and phenomena. The generalization of knowledge leads to a significant change in their quality, to the assimilation of the core of knowledge, their system. In this sense, generalization is closely connected with the principle of generalization, which assumes that the result of student learning is a knowledge system in which the particular is subordinate to the general, the non-essential and the secondary to the main [4].

The generalization of knowledge and skills of students in physics is facilitated by the so-called generalized plans for the study of certain elements of knowledge, the formation of various experimental skills developed by A.V. Usova (30).

There are several types of systematization of knowledge. The most important is the classification - a type of systematization in which the association of objects occurs on the basis of certain essential features, which allows us to distinguish the essential, general, which combines the objects into a system and their specific differences [6].

Another type of systematization is the establishment of logical genetic relationships, reflected in the definition of concepts.

The systematization of knowledge can be aimed at establishing causal relationships between phenomena. In particular, after studying the initial information about the structure of matter, students can be asked to explain a number of phenomena on the basis of certain provisions of the molecular-kinetic theory and compile an appropriate table. When studying the electric field, very often the teacher turns to the establishment of cause-effect relationships, for example, when studying the rheostat and the principle of its action.

Systematization can be carried out by comparison, i.e. establishing similarities, differences or analogies between objects and phenomena. Moreover, the similarity or difference is not only established, but their reasons are also explained (34). An example is a comparison of electrostatic and gravitational fields, electrostatic and magnetic, etc. The results of the

generalization and systematization of knowledge can be presented in the form of tables, diagrams, diagrams, supporting abstracts.

Systematization and generalization are closely related in the process of processing the received educational information. The teacher must use the natural processes of systematizing and summarizing the information that flows spontaneously in schoolchildren. This need is explained by the fact that students who do not have time to process and learn sharply increasing the flow of information presented in the previous way, which reduces academic performance and causes a loss of interest in the subject and teaching. Several approaches to systematization and generalization can be noted:

–First of all, figuring out "what we generalize", Betev V.A. identifies three areas - the studied objects, symbols, concepts;

— considering means of generalization, allocate schemes, tables, graphs, systems of equations, classifications with the establishment of causal relationships;

- Speaking of time, you can indicate - in each lesson, after studying a topic or section, at the end of the school year in generalizing lessons;

- presentation form - the teacher himself organizes and summarizes the lesson; accomplishes this together with students in a lesson; gives a similar task to students for independent performance in class or at home.

Arming students with a knowledge system is one of the most important tasks of teaching physics. In didactics, the principle of systematic and consistent teaching has long been proclaimed. It involves: a) the study of material in a certain sequence, consistent with the logic of science, the foundations of which are studied in school; b) the formation in schoolchildren of a system of scientific concepts, abilities and skills. This principle underlies the construction of curricula, defines the system of work of the teacher and student activities in the learning process.

Systematization is not limited to classification. The establishment of cause-effect relationships and relations between the facts studied, the allocation of the basic units of material, which allows us to consider a specific object as part of the system, also leads to systematization. Systematization is preceded by analysis, synthesis, generalization, comparison, the results of which are used and summarized in systematization.

Systematization of the course of mechanics. When teaching mechanics in a secondary school, certain educational, educational tasks and tasks of the development of students are solved. Educational tasks are determined primarily by the fact that in mechanics they introduce the basic concepts (mass, force, momentum of the body, energy, etc.), which are the "tool" of knowledge in science - physics. In this sense, mechanics can rightly be considered the foundation of physics. In mechanics, students become acquainted with physical theory - classical Newtonian mechanics and generalizations such as the law of universal gravitation, the laws of conservation of momentum and energy, and the general equilibrium conditions of mechanical systems [8].

Educational tasks (the formation of a scientific worldview) are solved by means of a dialectical materialistic view of nature and its cognition, the formation of polytechnical knowledge and skills (knowledge of the scientific foundations of modern mechanization of industry, transport and agriculture), the discovery in physics lessons of the main directions of development and acceleration in modern production , education of patriotism and internationalism, labor education. The basis of labor education in physics lessons in the study of mechanics is

polytechnical training, during which students are introduced to one of the main directions of modern production - mechanization. Students learn about simple mechanisms, various types of transmission of motion, laws of motion, etc. When conducting laboratory work, they learn some practical skills in dealing with measuring instruments. Diligence is also brought up by the work of scientists and inventors [7].

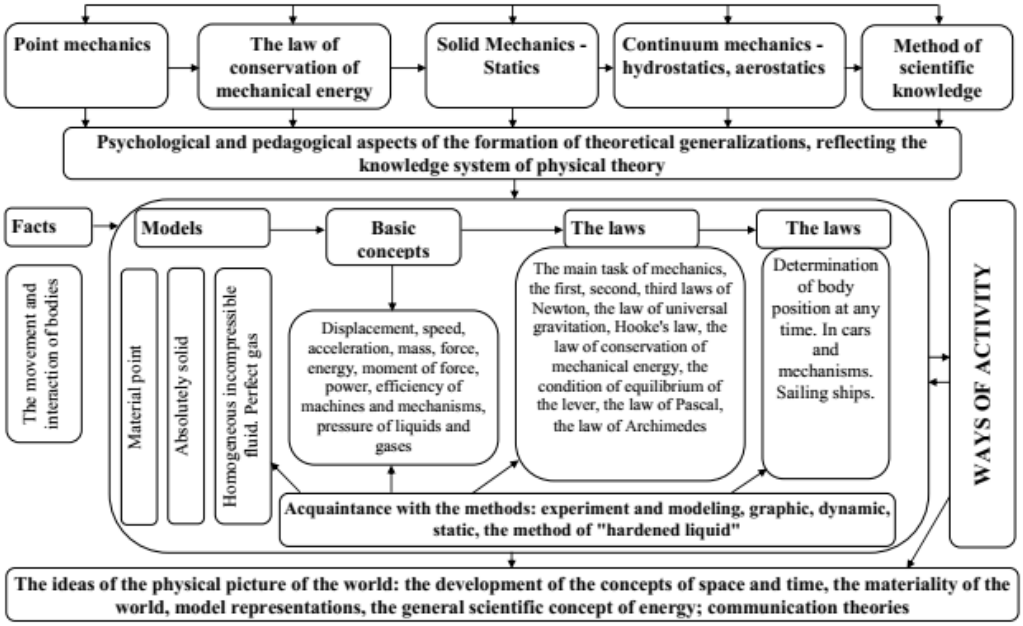
RESULT AND DISCUSSION

Solving the problems of developing education in the study of mechanics is aimed at the development of logical, theoretical, scientific, technical, dialectical and, therefore, the development of their intelligence and creative abilities. The logic of mechanics is also slender, the wide support in mechanical theory of such general methods of cognition as analysis and synthesis, induction and deduction, contribute to the development of logical thinking of students. The presence of scientific generalizations in mechanics contributes to the formation of theoretical thinking, the peculiarity of which is the ability to distinguish the main thing reflected in abstractions and to draw concrete conclusions from the latter, moving from general to particular.

In mechanics, schoolchildren come across a large number of abstract concepts - a material point, a reference frame, uniform and uniformly accelerated motion, etc. When studying these concepts, students are taught to highlight the essential features of phenomena and objects, reject non-essential ones, show how idealization arises in science, how abstraction occurs [4].

Appeal to physical theory (classical Newtonian mechanics) contributes to the formation in schoolchildren of ideas about the physical picture of the world - one of the most common forms of reflection of nature by physical science and one of the components of the scientific worldview, shows the dialectic of views on the physical picture of the world and the place of mechanical theory in this picture. When studying the main generalizations (the law of universal gravitation, the laws of conservation of momentum and energy, general conditions of equilibrium, etc.) they explain to students that the objectivity of scientific generalizations is confirmed by the use of the latter in the practical activities of people (space flight mechanics, the movement of machines and their parts, the implementation of equilibrium conditions in technical facilities). The study of the causes of changes in speed and deformation contributes to the disclosure of cause and effect relationships. The determination of the limits of applicability of classical mechanics helps to illustrate the knowability of nature and the limitlessness of the process of cognition. All this contributes to the formation of dialectical thinking.

Table 1. Generalized structural diagram of mechanics



Consider the main features of the course of mechanics. The first feature is that with the mechanics begins the study of the course of physics in high school. This determines the place of mechanics in the general education course in physics and requires the teacher to pay attention to students' solid assimilation of material. The second feature is that in mechanics the physical theory is presented quite fully. Therefore, the teacher is given the opportunity to illustrate the structure of a physical theory using the example of mechanics. And the third feature is the use of experiment in the teaching of mechanics.

At the stage of generalization and systematization of knowledge on the course of mechanics, you need to refer to table 1. Thus, the repetition and consolidation of the material will be accompanied by the formation of multilateral relations between the material studied and based on problematic issues and solving cognitive problems. You can, of course, write down all the well-known formulas and formulate the basic laws, although this work needs to be offered as a leading homework, and you can diversify the activity by compiling situational tables on the topic or using ready-made material. The convenience of the table is obvious: generalization and repetition is not reduced to the formal restoration of existing knowledge, but to the construction of a closed image of the phenomena and processes under consideration (4).

CONCLUSION

The paper reveals the essence of systematization and generalization in physics lessons. The role of these processes is great, since not only the quality of the digestible material is improved, but also the ability to analyze, abstractly represent many concepts and definitions is developing.

One of the teachers' problems is the understanding of generalization as the usual repetition of material consisting in recalling formulas and solving problems. In fact, the systematization and generalization of a broader concept, which includes creative tasks that contribute to the development of analytical thinking.

Thus, the tasks set were fulfilled: a stating experiment was carried out, articles and educational

materials on this issue were reviewed and analyzed, tables and diagrams were compiled on the basis of the material studied.

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