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TÍTULO: Enfoques innovadores para el desarrollo de la educación ambiental en la escuela secundaria.

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RESUMEN: El artículo está dedicado a la formación de una persona con un alto nivel de cultura ecológica, cuyos componentes son una nueva conciencia ambiental, pensamiento ecológico y cosmovisión ecológica. Este artículo revela enfoques innovadores para el desarrollo de la educación ambiental en la escuela secundaria moderna. El documento considera los problemas de la educación ambiental en una escuela secundaria moderna por los objetivos de la educación general en las condiciones de las tecnologías innovadoras. En vista del análisis científico y pedagógico de la literatura relevante y la documentación normativa, se identifican y justifican las etapas didácticas y las direcciones de modernización de la educación ambiental en la etapa actual.

PALABRAS CLAVES: temas ambientales, progreso científico y tecnológico, medio ambiente, salud humana, educación ambiental.

TITLE: Innovative approaches to the development of environmental education in high school.

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ABSTRACT: The article is devoted to the formation of a person with a high level of ecological culture, the components of which are a new environmental consciousness, ecological thinking, and ecological worldview. This article reveals innovative approaches to the development of environmental education in modern high school. The paper considers the problems of environmental education in a modern secondary school by the objectives of general education in the conditions of innovative technologies. In view of the scientific and pedagogical analysis of the relevant literature and normative documentation, didactic stages and directions of modernization of environmental education at the present stage are identified and justified.

KEY WORDS: environmental issues, scientific and technological progress, environment, human health, environmental education.

INTRODUCTION.

The modern natural-scientific picture of the world is unthinkable without a reflection of environmental problems. Today, the interaction of society and nature due to the emergence of new fields of science, technology, production and expand the scope of people's work influence on the world has become so small that the human intrusion into nature cannot be chaotic and limitless.

The current environmental situation requires a change in the attitude of society and man towards environmental problems (Mamedov, 2001). Therefore, environmental upbringing and education are important in education.

The main task of environmental education is to equip students with a certain amount of specialized knowledge and skills necessary for life and work. Ecological education of schoolchildren and professional environmental training of future specialists, undoubtedly, occupy the most important place and play a special role in the formation of environmental awareness and environmental culture (Kolesnikov, 2010; Imashev & 2019).

Today, in the context of social reform, a difficult socio-economic situation, the pace, and direction of the country's future development are largely provided by the person's potential capabilities and his health.

The state of people's health is not only an important indicator of social development but also a powerful economic, labor, defense and cultural potential. Currently, environmental education and upbringing in general. Without environmental education, the formation of environmental awareness is impossible.

DEVELOPMENT.

Environmental education and upbringing as factors of social, economic and moral development of society.

The following elements should be included in the content of school education: a system of knowledge about the interaction of society and nature, value environmental orientation, a system of norms and rules of attitude to nature, and skills for its study and protection (Zverev, 2005; Ermakov, 2009; Imashev, Baimukhanova, & Ergalieva, 2013).

The study of the physical aspects of environmental education leads to a deep and lasting assimilation of educational material, full environmental training of students and their professional orientation; the ability to use knowledge to actively protect the environment; deepening and expanding students' knowledge of physics; strengthening the environmental focus in order to more effectively prepare students for participation in the development of a new direction of scientific and technological progress, which is extremely important for improving educational progress. The analysis shows that the scientific knowledge studied at school performs not only cognitive, worldview, but also ecological functions.

At present, students of a comprehensive school receive knowledge on engineering and technology, economics, and the organization of production in various ways that make up the system of environmental training in secondary schools (Zverev, 2005; Imashev & Rakhmetova, 2019). An obstacle in this direction is the lack of modern educational and intellectual resources caused by the unsatisfactory state of modern science.

The enrichment of the methodological basis of environmental education is especially important: the use of innovative methods of communication in the learning process, the use of new information technologies with the use of computer programs, interactive video, eco-monitoring, modeling of environmental processes and many others.

From the above, the following main problems of school environmental education can be distinguished: there is no system of continuous environmental education; few practical lessons in ecology, as a result of the lack of ecology hours in the curriculum; there is a shortage of material resources: there is no appropriate equipment, materials for organizing practical work within the classroom system; insufficient theoretical and practical preparedness of teachers for environmental education.

Purpose of the study.

The formation of environmental knowledge and skills necessary to understand the processes occurring in the "man-society-technology-nature" system, to contribute to the solution of socio-environmental problems in modern society.

Environmental education is a continuous process of training, education and personal development, aimed at the formation of a system of knowledge and skills, value orientations, moral and ethical and aesthetic relations that ensure the environmental responsibility of the individual for the state and improvement of the social environment (Zverev, 2005; Polat, 2007). The goal of environmental education is the formation of a new type of person with new ecological thinking, able to realize the consequences of their actions concerning the environment and able to live in relative harmony with nature.

Theoretical aspects of environmental education and upbringing are developed by scientists such as I.D. Zverev, A.N. Zahlebny, B.G. Johansen, N.A. Rykov, I.T. Suraveginova, A.P. Sidelkovsky, E.S. Slastenina, S.N. Glazachev, N.D. Andreeva, N.P. Nesgovorova, T.M. Nosovoy, A.V. Mironov, A.V. Afonin, E.H. Dzyatkovskaya, D.S. Ermakov, G.A. Yagodin, and others. Currently, the following main components of environmental education are known in science such as scientific, normative, value, creative (Ermakov, 2009; Imashev, 2012a).

A significant role in solving environmental problems should be played by environmental education and enlightenment, the conceptual basis of which should be considered the concept of sustainable development of civilization. The solution to environmental problems is possible only if a new type of environmental culture is created, greening education by the urgent needs of the individual and civil society.

The scientific novelty of the work is as follows:

- Socio-economic and pedagogical principles that determine the main role of environmental education in the development of practical training of students in high school are defined.

- Innovative approaches to organizational forms and methods have been developed that ensure the effectiveness of environmental education in modern society.

- The system of students' environmental knowledge and skills was substantiated when studying the course of electrodynamics in high school at the present stage.

The practical significance of the work lies in the fact that on its basis the educational and methodological materials were developed and introduced into the practice of secondary schools in the western region of the Republic of Kazakhstan on the formation of environmental knowledge and skills of secondary school students in the process of teaching a general physics course.

The practical implementation of the system developed by the authors for the formation of environmental knowledge and skills of secondary school students has contributed to increasing the effectiveness of this process. The environmental problems of our time, as you know, are becoming extremely acute and global, and today's younger generation will have to solve them, in connection with which it is necessary to form in schoolchildren a conscious caring attitude to the world around us.

The need for environmental education is determined by the need to provide a favorable environment for human life since the destruction of the system of environmental relations and the lack of responsibility to future generations are one of the components of the crisis environmental situation (Ermakov, 2009; Imashev, 2015). Currently, in the conditions of the ecological crisis, awareness of the state of the environment, knowledge of the laws of nature, the ability to put them into practice is the basis of school environmental education.

The greening of the education system is a characteristic of the trend of the penetration of environmental ideas, concepts, principles, approaches into other disciplines, as well as the training of ecologically competent specialists of various profiles. An effective system of environmental education is one of the main tools for ensuring sustainable development of the economy and society.

The environmental education system is a combination of necessary and interacting organizational forms that implements the goals and objectives of continuous environmental education in the general education and upbringing system (Likhachev, 1993; Imashev, 2012b). It includes the infrastructure of environmental education, management, staffing, legal regulation, scientific, methodological and economic component. The described system of environmental education is displayed in Figure 1.

The success of environmental education and training depends on the use of various forms of work, their reasonable combination. It should be noted that environmental education requires an indispensable combination of cognitive and practical activities, a change in the methods of scientific, ethical, aesthetic, and practical development of not only nature itself, but also how much a person has a real relationship to it in concrete affairs and behavior.

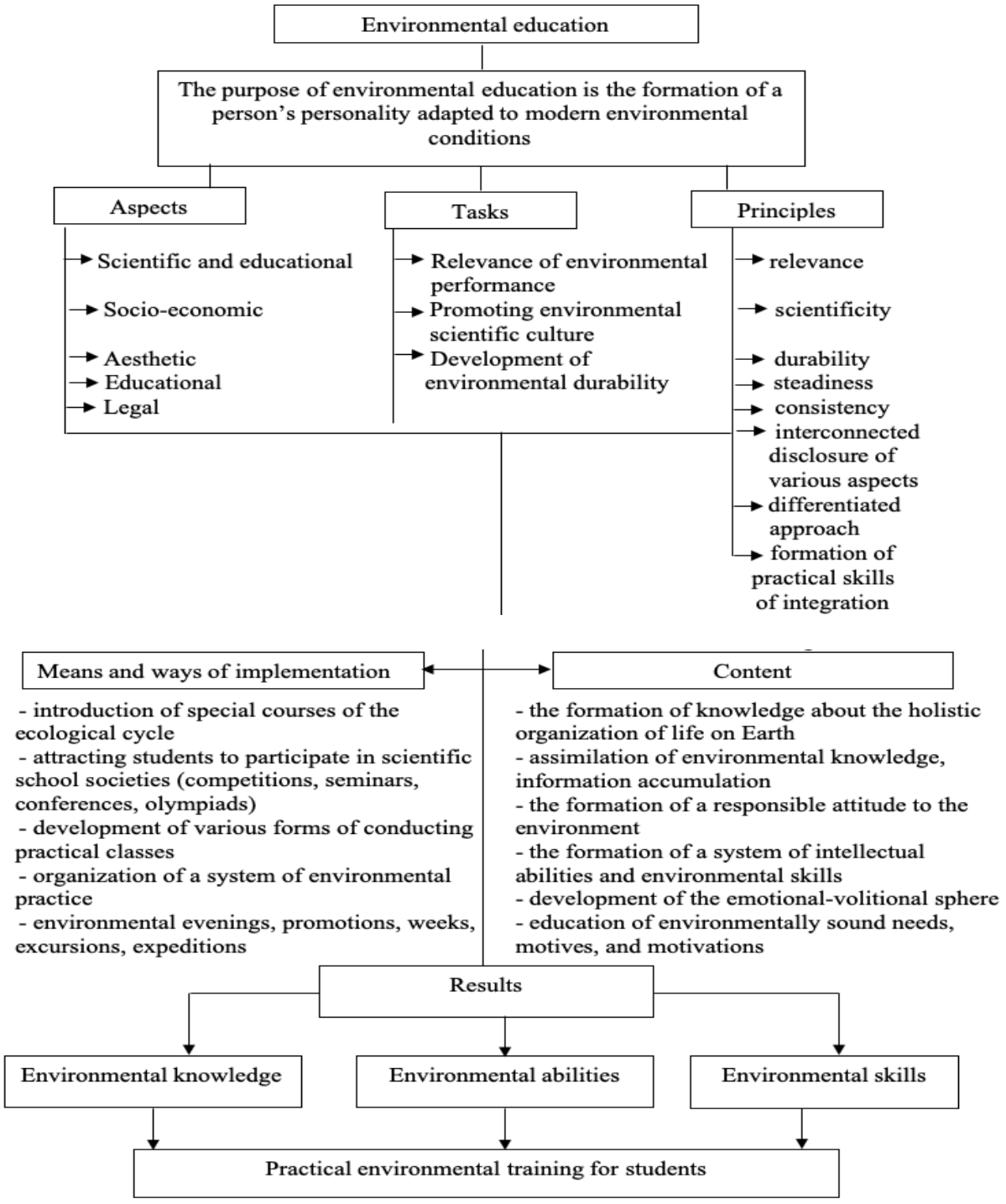

Figure 1. Environmental education system in high school

The forms of environmental work at school can be different:

- Research (compilation of an environmental passport of the school, issuing an environmental bulletin, studying the composition of air, water, soil, etc.).

- Competition (exhibitions of posters, drawings, conducting environmental competitions, etc.);

- Gaming (eco-case, eco-casino, eco-boomerang, etc.).

- Cognitive one (lecture lessons, seminar lessons, round tables, analysis of scientific literature, debates, tours, trips, etc.).

- Productive one (planting flowers, trees, landscaping school recreation, etc.) (Mamedov, 2001; Nikolaev, 2002; Imashev, 2011a).

Moreover, the innovative method, the method of environmental projects is the most effective in the environmental education of schoolchildren, which is based on the development and improvement of cognitive skills and critical thinking techniques of students, the ability to independently construct their knowledge, search, select and systematize the necessary information, navigate in the ecological space. Project technology is one of the innovative technologies of training and education that ensures the formation of environmental competencies.

The application of the method of environmental projects creates an innovative activity, practical development, creative and research environment, which helps to increase the motivation of educational activities, which takes on a problematic research focus. This is the dominant factor in the process of acquiring environmental knowledge by students, the skills of independent research work, the acquisition of new experience - environmental search and advanced design, as a result of which the following environmental competencies are formed:

- Social one, involving the formation of the ability to take part in decision-making related to the protection of the environment, to assume environmental responsibility.

- Informational one expressed in the ability to use different sources of information and process them.

- Communicative one, expressed in the ability to acquire new environmental knowledge throughout life and the ability to convey it to others in an accessible form for them (Polat, 2007; Imashev et al., 2016).

The use of innovative technologies makes it possible to study environmental problems, anthropogenic impact on nature in an interesting and accessible way through a practice-oriented approach, and also activate students' creative abilities, develop memory, critical thinking and ingenuity. Applicable to environmental education, this circumstance makes it possible to simulate real natural and life situations in a certain information environment. Information technology, being inherently a system of teaching methods that provide optimal and effective perception, assimilation and use of educational information in an interactive mode, is most suitable for solving educational and upbringing tasks of environmental education.

One of the innovative technologies is the case technology. Case technology is an analysis of a situation or a specific case, a business game. Its main purpose is to develop the ability to analyze various problems and find their solutions, as well as the ability to work with information.

Computer technology and multimedia presentations.

Information and computer technologies are firmly included in the system of environmental education, are widely used to improve and update forms and methods of working with students.

The innovative technologies that we use in educational and design research activities positively affect the quality of training and education, contribute to the formation of key competencies of students and also increase the professional level of a teacher (Bugayev, 1981; Nikolaev, 2002). In the course of the experimental work at the lessons, information and communication, training,

design, game, interactive technologies, problem education were used. But to teach a schoolboy ecology only in lessons is impossible. Other forms and methods of work are needed such as classes in a circle, field trips, and extra-curricular activities. In addition, interactive forms of education such as quizzes, conversations, role-playing games, projects, discussions, disputes, environmental evenings, performances, poetry evenings about the beauty of nature, poetry contests, etc.

The introduction of ecologization in the educational process ensures the development, a high level of schoolchildren's efficiency, and the high efficiency of the educational process. Environmental knowledge is necessary to improve the educational process itself: to form a holistic picture of the world, ideas about the interaction of society and nature under the conditions of scientific-technological progress, deep and lasting assimilation of program material, full environmental training of students and their professional orientation. Acquaintance with the greening of engineering and technology allows us to deepen our understanding of the development of fundamentally new areas of scientific-technological progress (Deryabo & Yasvin, 2006; Imashev et al., 2019).

To solve the environmental problem, orientation is also required by the objective logic of the technical development of nature towards creating the necessary scientific basis for harmonizing human technical activity with processes in the natural environment, and for managing natural factors. In this case, the organic relationship of technical objects and the environment should be considered.

Currently, human life and activity are not possible without the use of various technical means. Moreover, all of them, as you know, are sources of electromagnetic radiation. The most harmful are high-frequency radiation of the centimeter range. Mobile communications are still operating at the very beginning of this range, but the operating frequency is constantly increasing. First of all, irradiation causes changes, and even damage to tissues and organs. The mechanism of energy

absorption is quite complicated. The action of electromagnetic fields on the human body is manifested in a functional disorder of the central nervous system. Subjective sensations, in this case, are increased fatigue, drowsiness, or, conversely, sleep disturbance, headaches, etc. With systematic exposure, persistent neuropsychiatric diseases, changes in blood pressure, and slow heart rate are observed (Imashev, 2011a; Imashev & Rakhmetova, 2019).

Lasers or optical quantum generators (OCG), are currently widely used in various industries to perform technological operations such as welding, cutting, drilling holes in materials of any strength, as well as for performing measurement and control operations.

OCG emission can cause a variety of general functional disorders, manifested in increased irritability, fatigue, sleep disturbance, severity and pain in the eyes. The radiation of OCG in the visible spectrum has a more pronounced local and general effect, causing changes in the function of vision, especially in low light. The most common in everyday life is a low-frequency (50Hz) alternating magnetic field. In descending order of danger to human health, household appliances can be arranged as follows: microwave, electric stove, TV, washing machine, refrigerator, electric shaver, iron, electric kettle.

A special role in the assimilation of environmental knowledge by students was assigned to the principle of polytechnical education. All issues that reveal the physical aspect of nature conservation and its rational use included the technical application of physical ideas as well as consideration of one of the main requirements for the current technology - its environmental friendliness (Imashev, 2011a; Imashev, 2012c; Imashev & Kuanbayeva, 2019).

The content of the environmental material in the physics course is shown in Table 1.

Table 1. The system of environmental knowledge formed in the course of electrodynamics.

Section, the topic of the course	Environmental Knowledge Content	Forms and methods for the formation of environmental knowledge
Electric field	The effect of the electric field on human health and other living organisms. A decrease in the electric charge of the Earth, a change in its magnetic field. The electric field in the atmosphere.	Conducting a heuristic conversation. Student assignments: study the effects of electrostatics on human health.
The flow of direct current	The value of static electricity in nature, technology, and everyday life. Electric lighting.	Project protection. Solving problems with environmental content.
The electric current in electrolytes	Sources of pollution, wastewater treatment methods. Ecological problems of energy. Electrification of technological processes.	Story. Demonstration of the action of the electroflotation method of water purification. Computer modeling.
The electric current in gases	Ionization of air. Ecological energy converters. The gas composition of the atmosphere. MHD generator.	Lecture. Interactive technology. Training. Demonstration of gas ionization. The solution of experimental problems.
The electric current in semiconductors	Using the energy of the Sun. Environmental friendliness of the energy of the Sun, its use.	Conversation. Independent work with popular science literature. Performing creative tasks.
Magnetic field. The magnetic properties of the substance	Magnetic field and living organisms. Vortex electric field and its effect on a living organism. Earth's magnetic field. Methods of wastewater treatment from impurities.	Demonstration of the principle of magnetic separation. Case technology. To prepare an essay on the theme "Living organisms in an electromagnetic field".
Electromagnetic radiation. Electromagnetic field	The effect of electromagnetic waves on a living organism. Radio waves and man. High-intensity electromagnetic field. Narrowband electromagnetic radiation.	Conference on the topic "Electromagnetic field". Demonstration of a training video. Multimedia presentation.
Electromagnetic waves	The impact of electromagnetic waves on human health and living organisms. Electromagnetic radiation. Increased radiation. Protection against electromagnetic radiation. The impact of power plants on the environment.	Protection of projects on the topics "Electromagnetic radiation and ecology", "Electromagnetic fields of cell phones", "Electromagnetic fields of household appliances", "Electromagnetic fields of a personal computer monitor".

When determining the content of environmental and nature-oriented knowledge, we proceeded from the fact that:

- Their volume should include the minimum number of concepts specific to these sciences that ensure that students realize the social significance of this idea.

- The introduction of selected environmental and nature-oriented knowledge should not violate the existing system of physical knowledge.

- Environmental and nature-oriented knowledge to be assimilated must meet the principles of science and accessibility.

In the course of the study, it turned out that at the first stage of the formation of environmental beliefs, it is most advisable to use information-communicative methods such as a story, a heuristic conversation, a demonstration experiment, and problem-solving. When consolidating environmental knowledge at the second stage, the most effective were conversations of a problem-generalizing nature, working with government documents, lessons - conferences, seminars, thematic evenings. The environmental knowledge system has certain specifics. This knowledge is formed as a result of the establishment of causal relationships between natural science, special and technical concepts in close connection with the system of moral standards of attitude to the environment accepted in society.

In order to identify the level of knowledge and skills in the educational process in both experimental and control classes, verification work was carried out. At the same time, students' answers were divided into three categories according to the levels of knowledge and skills such as low, medium and high (Imashev, 2011b; Imashev & Gubasheva, 2018).

The levels of ecological preparation of students in the process of studying physics are presented in the form of Table 1. Table 1 shows a comparative characteristic of quantitative indicators of the levels of formedness of environmental knowledge and skills of students in experimental and control classes.

As can be seen from Table 2, the number of students with a low level of formedness of environmental knowledge and skills in experimental classes is 3 times less than in control classes; 85% of students in experimental classes showed medium and high levels, and 52% in control classes.

Table 2. The level of formedness of environmental knowledge and skills

Class / Level	Experimental		Control	
	Number of students	%	Number of students	%
High	237	28	109	13
Medium	483	57	324	39
Low	127	15	399	48
Total	847	100	832	100

The obtained levels of knowledge and skills formation show that there was an increase in the knowledge of students in experimental classes at all three levels compared with the results of a stating experiment.

The data presented indicate that the level of environmental knowledge and skills in the experimental classes increased by an average of 16% compared with the control class. The results obtained in the experimental classes in comparison with the results of the control classes prove the effectiveness of introducing ecologization into the educational process of the various forms of work that we offer.

CONCLUSIONS.

Environmental education is a continuous process of training, self-education of a person, accumulation of experience, during which the development of the personality itself takes place, as value orientations are formed based on special knowledge gained on environmental protection and nature management, which become the content of norms of behavior in everyday life. Besides, environmental knowledge allows you to make a much safer and healthier life, and not only your own, but also those around you.

As shown by the study and pilot work, environmental education and upbringing of schoolchildren in the process of teaching physics develop some environmental skills, helps to understand the interconnectedness, interdependence, and integrity of phenomena and processes that occur in the biosphere.

The systematic application of the various forms of work of environmental education that we offer increases the general level of environmental knowledge and skills arouses interest in studying the physics course and the quality of its teaching at the present stage.

Thus, environmental education can be considered as a necessary element of the general secondary education of youth associated with its mastery of the scientific foundations of the interaction of nature and society. At the same time, environmental knowledge acts as a link between the theoretical information acquired at school and practice, life.

In the future, work on the study of environmental education of students in the learning process can be carried out in the following areas:

- Modernization of the system of organizational and pedagogical support of environmental education, considering the study of innovative technologies;

- Improving the environmental training of teachers in modern society.

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