

Opportunities of ecologization of physics course

N. Shuyushbayeva^{1*}, A. Kaliyeva¹, N. Tanasheva², G. Altayeva², M. Talpakova³

¹*Sh.Ualikhanov Kokshetau University, Kokshetau, Kazakhstan*

²*Buketov Karaganda University, Karaganda, Kazakhstan*

³*L.N.Gumilyov ENU, Nur-Sultan, Kazakhstan*

Received: November 15, 2021; Revised: May 18, 2022

In the modern educational space, the priority of environmental aspects is based on solving environmental problems as a leading role of education. The article considers and analyzes the possibilities of considering environmental issues in the course of physics - the most common scientific and methodological literature. In addition, the methodological and psychological, as well as pedagogical bases of the conditions of formation of environmental education and upbringing are studied. The main goals, principles, and objectives of environmental education and upbringing in secondary school are given. In the context of the study, the most important areas that link ecology with physics are identified. The content of the course of physics in the environmental direction is marked by optional interpretations of this knowledge in accordance with the issues of environmental education, such as compulsory education. The greening of education allows us to imagine the human activity in the natural environment and to address regional and global environmental issues. The article states that the essence of many environmental laws is that they are realized in connection with the fundamental laws of nature, and the flow of energy and metabolism in ecosystems is governed by general natural laws.

Keywords: physics, ecology, nature, laws, ecological culture, facts.

INTRODUCTION

The main mechanism of formation of ecological culture is the target system of ecological education and training, including pre-school, primary, secondary, higher education, advanced training, retraining, promotion of scientific knowledge.

Environmental issues in the physics course are clearly discussed in scientific and popular literature. Among them are E. A. Turdikulov's "Environmental education and upbringing of students in the process of teaching physics"; "Environmental monitoring of the school", T. Ya. Ashikhmina's publication, A. F. Boriskin, N. A. Ivanova "Ecology in school physics"; Sh. G. Ziyatdinov "Environmental education in the process of teaching physics", "Issues of ecology in the teaching of physics and astronomy", D. G. Maslova, B. B. Alekseev "Physics and Ecology"; A. P. Ryzhenkov "Physics and Ecology"; A. P. Novikov "Environmental aspects of cosmonautics"; V. A. Nikerov "Ecological house. Physics advice"; Yu. L. Khotuntsev "Man, technology, environment", V. A. Yatskevich "Problems of Physics and Ecology" and others [1-9].

The formation of the complex of environmental education, which is the basis of the content of environmental education, is most closely linked with physical thinking and knowledge is shown in Table 1. Also, the theoretical and methodological guidelines developed in the learning process are

slowly entering. In physics programs, only individual environmental questions are included in the physics course, and in the problem set only 1-2% of their total number are devoted to environmental issues.

It is known that to date there is no concept of "environmental education" in the methodological literature and the possibility of its application in the teaching process. In recent years, many researchers have adopted the concept of environmental education as a process aimed at shaping the ecological culture of the individual.

In the concept of "environmental culture", it is necessary to create a culture that is the basis for the preservation and development of "society-nature". Ecological ethics is a measure of ecological culture.

Methods

Environmental education in the educational process is carried out through the introduction of environmental education and direct environmentalization of the education system.

General environmental education is the direct acquisition of environmental knowledge of different nature and level, which has two main directions:

- education of ideas in the spirit of environmental protection and human health;
- finding special professional knowledge about the general laws of education of natural and anthropogenic systems.

* To whom all correspondence should be sent.

E-mail: nn_shuish@mail.ru

Environmentalization of the education system is a description of the process of penetration of environmental ideas, concepts, principles into other disciplines, as well as the training of environmentally literate professionals of various profiles [10].

Currently, there are three main models of environmental education:

- multidisciplinary model - assumes the greening of disciplines;
- introduction of one-subject - general ecological education;
- combined - in each subject and as a whole - individual disciplines in terms of environmental issues.

Table 1. Conceptual aspects of greening the course of physics in interaction with the system of environmental education in accordance with the concept of environmental education

Substantive ways to consider environmental concepts from a physical point of view	Elements of physical knowledge in the interpretation of environmental concepts
Global megaecology. Object: biosphere. Physical features of construction, life and evolution. The relationship between the biosphere and geosphere, the biosphere and the planet around the world. Physics of biosphere phenomena and processes. Physical pollution of the biosphere.	Planets and their cosmic environment. Day-to-day communications. Outside the planets: atmosphere, hydrosphere, lithosphere, and magnetosphere. Metabolism: geological, biogenic. Energy flow in the biosphere. Heat balance of the atmosphere and the earth's surface. Transformation of energy by living matter in the biosphere. Thermal, electromagnetic, radioactive, pollution. Equilibrium of the biosphere. Targeted values of physical effects on the biosphere and its elements.
Geographical ecology. Object: landscapes. Physical features of landscape formation. Physical bases of climatic processes. Physical parameters of geosys+tem resilience: physical norms of anthropogenic load on different types of landscapes.	Erosion of mountain seeds and land. Mechanical, thermal, electromagnetic, acoustic, radiation characteristics of the area (local geosystem). Climate is like physical influences. (natural and anthropogenic). Equilibrium of geoecosystems. Load on geoecosystems, load values.

Classical bioecology. Object: Ecosystem (organism level). The influence of physical factors of the environment on the nutrition of the union, the vital activity of various organisms and their ability to adapt. Evolution of physical factors of organisms and the environment. Influence of physical factors of environment on succession rate and characteristics.	Physical factors of the region: light, electromagnetic waves, spectrum, EMV, temperature, humidity, ionizing radiation, field characteristics, etc. (gravitational, electromagnetic) Adaptation of the organism. Heat exchange, heat balance. Metabolism (water and gas exchange). The impact of physical pollution on population health.
Human ecology. Human is a psychobiological system that interacts with the natural and socio-cultural environment. Physical factors of the environment and the human body in different climatic conditions. Human adaptation. Ecology of urban population: the impact of urban environmental factors on human health (noise, lighting, air ionization, ionizing radiation, etc.). Radio ecology: radiation as an anthropogenic factor of the environment, its impact on the gene pool and population of individuals.	Human adaptation. Influence of physical factors of the region on the gene pool. Human health. Physically stable living conditions.
Social ecology. The principles of physical cognition (methodological), as the basis of the scientific paradigm, were translated into the general cultural environment. Improving the means of production and research aimed at engineering and technical optimization of society and nature. Finding an optimal economic and environmental approach, a rational technical and engineering solution to meet the needs of society and man.	The experience of physical recognition of natural systems seems to be a key part of the scientific approach. The physical basis for the improvement of existing technologies and the invention of new technologies.

On the base of our research the following environmental issues in the physics course should be considered:

- methods of physics and scientific cognition: scientific methods of cognition of the environment and their differences from other methods of cognition; the role of experiment and theory in the process of recognizing nature; modeling of physical phenomena and processes; scientific concepts; physical laws; physical theories; boundaries of application of physical laws and theories; principles of conformity; basic elements of the physical image of the world; human development and modern environmental issues; physical ecology;

i) Mechanics: space monitoring of the biosphere; issues of development of environmentally friendly "clean" energy sources and prospects for their use; wind energy; Efficiency and environmental safety of various mechanisms; hydropower; issues of river energy consumption (loss of fertile lands, pollution of the region, climate change, etc.).

- noise of pollution of the environment; decrease of the natural noise background level or abrupt oscillation and change of such sound characteristics as frequency of sound wave and strength of sound flow; calculate the nature of noise, noise protection structures and sound insulation

ii) Molecular physics and thermal phenomena: energy flows in the biosphere:

- the effect of temperature on the biosphere; water circulation in nature;

- the phenomenon of evaporation on the surface of the seas and oceans and its impact on the Earth's climate;

- formation of acidic precipitates; the effect of water salinity on the freezing point; the importance of air humidity and its impact on ecosystems;

- the effect of air pollution on the condensation of vapor in the atmosphere; the combined effect of temperature and humidity on living organisms;

- the second law of thermodynamics of ecological content; issues of heat engines and air protection; thermal power plants and environmental issues.

iii) Fundamentals of electrodynamics: causal phenomena in nature; effects of magnetic and electric fields on the biosphere; biopotentials; basics of electrocardiography; biological action of static electricity:

- the effect of electric current on living organisms; physical bases of operation of defensive buildings; prospects for the development of electric transport; features of an electric motor, such as an environmentally friendly motor; use of semiconductor devices; environmental converters that convert heat and light energy into electricity; water pollution treatment; (electroflotation method of purification); method for determining soil salinity by its electrical conductivity; environmental aspects of electricity generation; biological effects of heavy and light ions; the concept of electrostatic precipitators; environmental energy converters; the effect of magnetic fields on living organisms; ionization of atmospheric air; ionosphere; biological effects of heavy and light ions;

- the effect of magnetic fields on living organisms; "magnetic" purification of water from impurities - magnetic separation;

- electromagnetic oscillations and waves: biological effects of high-frequency electromagnetic waves and their protection; ecological examination of various options for remote transmission of electricity;

iv) Optics: differences in reflectivity on different surfaces from an ecological point of view; changes in the purification of the atmosphere under the influence of anthropogenic factors, its environmental consequences; infrared and ultraviolet radiation; environmentally hazardous light factors; biological effects of infrared and ultraviolet radiation and their protection; the result of evaporation.

v) Quantum physics: alternative energy; solar energy; photo converters; the effect of laser radiation on the bioplasm:

- noise pollution of the environment; reduction of the natural background noise level or a sharp fluctuation and change in such sound characteristics as the frequency of the sound wave and the strength of the sound stream;

- calculate the nature of noise, noise protection structures and sound insulation.

vi) Radioactivity and ionizing radiation issues of radioactive waste disposal at nuclear power plants; safety at nuclear facilities; biological effects of radioactive radiation; physiological activity of neutrons and methods of protection against neutron radiation.

CONCLUSION

The content of the course of physics in the environmental direction is marked by optional interpretations of this knowledge by the issues of environmental education, such as compulsory

education. In this case, the material is collected to demonstrate the capabilities of the physical aspect in the formation of a set of environmental knowledge. Systematization of knowledge should be based on the structural elements of physical knowledge, taking into account the logic of scientific knowledge (scientific facts, the main components of systems considered from an ecological point of view, as well as the main components of the apparatus of understanding physics; laws; basic laws and theoretical principles.

REFERENCES

1. E. A. Turdykulov, Ecological education and educating schoolchildren in the process of teaching physics. A book for teachers, Moscow, Enlightenment, 1988.
2. T. Ya. Ashikhmina, School environmental monitoring, Moscow, AGAR: Rendezvous-AM, 2000.
3. A. F. Boriskin, N. A. Ivanova, Ecology in the school physics course, Textbook, Nizhnevart. Ped. Inst., Nizhnevartovsk, 1999.
4. Sh. G. Ziyatdinov, Ecological education in the process of teaching physics, Moscow-Birsk: BGSPA, 2005.
5. A. P. Ryzhenkov, Physics and ecology, Kolomen. Ped. Inst. M., Prometheus, 1989.
6. L. C. Novikov Environmental aspects of cosmonautics, Moscow, Knowledge, 1986.
7. V. A. Nikerov, Eco-friendly home: Physics advice, M., Energoatomizdat, 1992.
8. Yu. L. Khotuntsev, Ecology and ecological safety: a textbook for students, 2nd edn., M., Publishing house. "Academy", 2007.
9. V. A. Yatskevich, Physics and environmental issues, Vologod. State Ped. Inst., Vologda, 1997.
10. I. T. Suravegina, V. M. Senkevich, V. T. Kucher, Environmental education at school, Soviet pedagogy, 1990.