

# The role of physics in the formation of ecological education of schoolchildren

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**Abstract:** The article shows that the subject of physics occupies a large place in the formation of environmental education of schoolchildren. Physics as a science plays an important role in the formation of environmental knowledge, providing the necessary knowledge and tools for understanding and solving environmental problems. It helps to explain many natural phenomena that have a direct impact on the environment, and contributes to the development of technologies aimed at conservation and sustainable development. In recent decades, environmental education has become an integral part of school and university programs, since knowledge of environmental problems and how to solve them is a key factor in preserving our planet for future generations. Having shown that the greatest contribution of physics to environmental education is the ability to model and predict natural processes, he notes that with the help of physics it is possible to analyze climate change, study air and water pollution processes, assess the impact of various types of energy in the environment.

**Keywords:** Ecology, physics, curriculum, climate, responsibility, spectrum, modeling, nature, technology.

**Introduction:** Physics as a science plays an important role in the formation of environmental education, providing the necessary knowledge and tools for understanding and solving environmental problems. It helps explain many natural phenomena that have a direct impact on the environment and contributes to the development of technologies aimed at nature conservation and sustainable development. In recent decades, environmental education has become an integral part of school and university programs, as awareness of environmental problems and ways to solve them is a key factor in preserving our planet for future generations.

Environmental education includes the study of a wide range of issues related to the state of the environment and the impact of human activity on it. It is aimed at fostering an ecological culture, increasing environmental responsibility and stimulating active participation in nature conservation. In this context, physics acts as one of the basic disciplines, providing theoretical foundations and practical skills necessary for the analysis and solution of environmental problems [1-5].

J. Lawton emphasized that ecology is based on the laws of physics and chemistry. We cannot disagree with this, because the relationship between organisms and the environment is realized through physical factors. Even more "physics" in the consequences of human economic activity's impact on the environment [6].

The most significant contribution of physics to environmental education is the ability to model and predict natural processes. For example, using physics, one can analyze climate change, investigate air and water pollution processes, and assess the impact of different types of energy on the environment. Modern methods of physical analysis and modeling allow for the creation of accurate and reliable forecasts, which are used to develop sustainable development strategies and make informed decisions in the field of environmental protection.

In addition, physics plays an important role in the development of technologies aimed at reducing the negative impact on the environment.

This includes the development and implementation of energy-efficient technologies, renewable energy sources, air and water treatment systems, as well as

waste disposal methods. Environmentally safe technologies based on physical principles contribute to reducing harmful impacts on the environment and contribute to sustainable development.

The formation of ecological culture and consciousness begins with understanding the basic physical laws and their application to real environmental problems. It is important that schoolchildren realize that solving environmental problems requires not only knowledge of biology and chemistry, but also a deep understanding of physical processes. This contributes to a more comprehensive and systematic approach to environmental protection and the formation of scientifically sound sustainable development strategies and methods [7].

### **Main part**

Below, we will discuss how physics contributes to environmental education through various aspects, such as understanding energy processes and the impact of technology on the environment. In modern general education schools and natural science teaching, socio-cultural education is being implemented, which includes elements of environmental and ethical education of students. The significance of this direction is confirmed by both past and modern educational programs, which define the main tasks of education.

When developing the content of education, educators pay special attention to the relationship between man and nature in the educational process. It is emphasized that the unity of man and nature is possible only if there is knowledge about it. Therefore, environmental education includes not only environmental issues, but also aspects of human protection and its ability to survive in a cultural environment.

The content of the training, structured in accordance with these requirements, contributes to the implementation of environmental education in educational practice.

Physics provides fundamental knowledge necessary for understanding many ecological processes. Despite the existence of a significant number of studies dedicated to environmental indicators in different countries, relatively few works pay attention to environmental health as an independent component of these indicators, as well as the relationship between environmental health and national culture and the level of human development. This study proposes and empirically tests three models that examine the impact of cultural values and human development levels on environmental health. Various variables taken from the Human Development Index (HDI), Hofstede cultural measurements, and the Environmental Performance Index (EPI) are included. The hypothesis testing was

conducted using multiple linear regression models in a sample of 67 countries. The empirical results indicate that cultural dimensions such as individuality and avoidance of uncertainty, as well as human development components - expected life expectancy at birth, education level and income - have a significant impact on environmental health indicators, if these factors are assessed using individual models. However, a combined analysis, taking into account the influence of both national culture and human development, revealed a statistically significant impact solely on human development indicators. In the context of increasing anthropogenic pressure on Earth's natural resources and ecosystems, the task of developing more effective ecosystem management mechanisms is becoming particularly relevant. However, available data suggests that these efforts have not yet yielded the desired results, as evidenced by global environmental problems such as climate change and biodiversity loss [8, 9]. To improve and diversify ecosystem management strategies, it is necessary, first and foremost, to deepen understanding of their structure and functioning, as well as the ability to predict changes in response to anthropogenic and natural disturbances. Experience shows that, overall, it is currently difficult to systematically manage ecosystems [10] and predict their condition, even when attempting to reduce vegetation fragmentation [11], control the spread of invasive species [12], or regulate geochemical flows and resource consumption levels. While the statement "to predict does not mean to understand" [13] remains true, a deeper understanding of ecosystem processes undoubtedly contributes to improved forecasting and ultimately can improve management efficiency. Within the framework of existing research, the problems of ecosystem functioning are analyzed through the prism of concepts and methods borrowed from physics, as well as biological and socio-economic approaches. As a rule, ecosystems are considered to be systems subject to physical laws, which allows us to use physical concepts to describe them. In this context, physics is understood as a science that studies matter and energy in space and time. The original concepts of matter and energy conservation, along with the laws of thermodynamics, provided tools for analyzing resource flows within ecosystems and, consequently, for understanding their global functioning [14]. Within these approaches, species are considered as reservoirs of matter and energy that must be accounted for and regulated [15, 16]. Physical tools, such as diverse mathematical models, are successfully used to analyze environmental problems,[17] however, this study focuses exclusively on physical concepts and their relevance to understanding ecosystems. Based on these physical

concepts, ecologists have concluded that ecosystems are open systems, while physical theories such as thermodynamics are better suited to describe closed systems. Furthermore, there is no clear structural homology between physical and ecological systems. One reason for this observation is that ecosystems are not just physical systems. The presence of biological components in ecosystems, such as species, leads to distinctive features related to their evolution and natural selection. This contradiction, known as the dual problem of ecosystems, has prompted some researchers [18], including the author of this work, to propose more universal and perhaps radically new approaches to ecosystem research than traditional physical approaches. This knowledge encompasses a wide range of phenomena and mechanisms that are directly related to the environment and its state. Let's consider the key aspects that make up the physical foundations of environmental education.

**Thermodynamics and ecology.** Thermodynamics studies processes related to energy and heat. The fundamental laws of thermodynamics play an important role in understanding environmental problems. For example, the first law of thermodynamics, known as the law of conservation of energy, states that energy cannot be created or destroyed, but only transformed from one form to another. This law is important for evaluating energy flows in ecosystems and understanding processes such as photosynthesis and respiration.

The second law of thermodynamics, which states that entropy in a closed system always increases, helps explain why energy conversion processes are always accompanied by losses. These losses manifest themselves in the form of heat loss, which is important to consider when developing energy-efficient technologies and systems.

**Electromagnetic waves and their impact on the environment.** Electromagnetic waves play an important role in the study of the environment. Light, ultraviolet radiation, radio waves and other types of electromagnetic waves are used to monitor and analyze environmental parameters. For example, satellite imagery based on infrared and visible bands of the electromagnetic spectrum allows tracking the state of forests, water bodies, and agricultural lands.

Furthermore, understanding the impact of various types of electromagnetic radiation on living organisms is crucial for protecting human health and the environment. For example, the ozone layer protects us from harmful ultraviolet radiation, and its destruction can lead to an increase in skin cancer and other diseases.

**The law of conservation of mass and environmental pollution.** The law of conservation of mass, formulated by Lavoisier, states that the mass of matter in a closed system remains constant regardless of the processes occurring in the system. This fundamental provision is used to assess the balance of substances in ecosystems and to analyze pollution processes.

For example, understanding this law helps to analyze the ways in which pollutants spread in air, water, and soil. It also underlies the methods of waste cleaning and disposal, allowing for the accurate calculation of the required amount of reagents and the prediction of product yield.

**Fluid and gas mechanics.** Liquid and gas mechanics (hydrodynamics and aerodynamics) studies the motion and interaction of liquids and gases. These knowledge are necessary for understanding many ecological processes, such as atmospheric circulation, hydrological cycle, river and ocean flow dynamics.

Example: Understanding the dynamics of air masses allows you to predict weather and study climate change. This is also important for assessing the spread of pollutants in the atmosphere and developing measures to reduce them.

**Radioactivity and radiation protection.** Radioactivity is an important aspect of environmental education, as it has a significant impact on the environment and human health. Understanding the nature of radioactive decay, types of radiation (alpha, beta, gamma) and their interaction with matter allows for the assessment of risks and the development of protection methods.

Example: Monitoring of radioactive contamination caused by nuclear accidents or nuclear weapons tests requires the use of physical principles and methods. The development of technologies for the disposal of radioactive waste and the reduction of its impact on the environment is also based on the laws of physics.

## RESULTS AND DISCUSSIONS

The role of physics in shaping the ecological education of schoolchildren is very great. By teaching physics aspects related to ecology, students develop a sense of respect and attention to nature. This will help students understand how to protect the environment, effectively use energy resources and not harm nature.

**1. Expanding environmental knowledge:** In physics classes, students acquire knowledge about ecology, explaining environmental problems using energy, heat, electricity, and other physical phenomena. For example, the importance of studying and using renewable energy sources is explained. The physical foundations of environmental education play a key role in shaping a comprehensive understanding of

environmental problems and developing effective solutions. Understanding fundamental physical laws and principles allows students to better understand the relationship between natural processes and human activity, and also contributes to the development of environmental responsibility and culture.

**2. Development of environmental awareness:** Physics increases students' concern for the environment by studying environmental issues such as heat energy losses, global climate change, and others. Modern physics educational programs include environmental aspects, which contributes to the formation of students' environmental responsibility and readiness for active participation in environmental protection. Projects aimed at studying and solving environmental problems help students to apply physical knowledge in practice and develop innovative solutions.

**3. Studying green technologies:** Explaining green technologies in physics lessons, such as solar energy, wind turbines, and other environmentally friendly technologies, prepares students for innovations in this field. Example: environmental projects, such as researching the effectiveness of different types of solar panels or developing systems for collecting and processing rainwater, allow students to apply physical knowledge to solve specific environmental problems.

**4. Integration of physics and ecology:** It is necessary to strengthen the integration of physics and ecology, to develop methods that combine them in school programs. Presenting environmental problems in physics lessons not only teaches understanding of nature, but also helps young people to feel ecological responsibility in society.

**5. Innovative approaches:** To strengthen environmental education in schools, it is necessary to conduct innovative approaches such as environmental projects, excursions, practical classes. Thanks to this, students develop an ecological consciousness not only through theoretical knowledge, but also through practical experience.

**6. Pedagogical methods:** To achieve effective results in environmental education, teachers should use innovative pedagogical methods. Interactive lessons, the organization of experiments and project work develop students' environmental knowledge and activities.

At the same time, the role of physics in environmental education is important not only as a science, but also in increasing environmental responsibility in society. In the future, they can make a great contribution to the preservation of the environment by instilling ecological responsibility in students.

## CONCLUSIONS

### 1. The connection between physics and ecology:

The basic concepts of physics, such as energy, heat, electricity, and the use of natural resources, play an important role in shaping students' environmental awareness. Through physics, students are taught the importance of preserving the environment, using renewable energy sources and saving natural resources.

**2. Focus on environmental issues:** In physics classes, students will gain a deep understanding of environmental problems, such as energy conservation, prevention of heat and electricity losses, global climate change. This helps them take on environmental responsibility in society.

**3. Green Technology Training:** Through the integration of physics with environmental education, students acquire knowledge about green technologies, such as solar and wind energy. This will help to expand the use of environmentally friendly energy sources in the future.

**4. The importance of pedagogical approaches:** In the formation of environmental education, it is necessary to use modern pedagogical methods, conduct interactive lessons and practical classes. They help students acquire not only theoretical knowledge, but also practical skills.

**5. Future environmental responsibility:** The role of physics in the process of environmental education in school is of great importance in shaping the ecologically responsible thinking of students. Students understand environmental problems, are interested in their solutions, and contribute to the preservation of the environment.

Therefore, the integration of physics with environmental education serves as an important tool in shaping students' conscious attitude towards the environment and teaching them how to use modern technologies correctly and effectively.

## REFERENCES

Зиятдинов Ш.Г., Миркин Б.М. Роль курса физики в экологическом образовании учащихся. // Вестник Башкирского университета. 2006, вып. 11, № 2, стр. 127-130.

Зиятдинов Ш.Г. К изучению экологических проблем современности в школьном курсе физики. // Символ науки, 2018, № 8, стр. 67-69.

Пономарева И.С. Роль физики при формировании экологического стиля мышления в процессе обучения. // Мир науки, культуры, образования, 2010, № 1. - стр. 203-205.

Имашев Г. Экологическое образование в курсе физики // Вестник Атырауского университета. 2022, вып. 65(2), стр. 59-71.

Kamalov A.B., Ashirbekova S.U., Serimbetova M.P., Baymuratov Sh.J., Aytmuratov B.Sh., Eshbaeva M. Synergy of Current Knowledge in Physics, Agrometeorology and Modern Technologies in Agriculture // Journal of Computational Analysis and Applications 2024, № 7, Vol. 33, pp. 1159-1161.

Lawton J.H. Are the general laws in ecology? // Oikos, 1999. V. 84. № 1. P. 177-192.

Отарбаев А. Методика формирования интереса школьников к физике. // Ta'lim fan va innovatsiya. Ташкент. 2024. №3 С. 8-10.

A.S. Muratov, A.B.Kamalov, S. A. Tursinbaev. Installations for studying the strain properties of silicon with nanoclusters of impurity atoms // Science and Education in Karakalpakstan. 2021 №2 (17). ISSN 2181-9203. С. 4-7.

Готовцева Л. М., Протождьяконова А. А. Профилизация учащихся 9 класса посредством элективного курса «альтернативная электроэнергетика» // Ответственный редактор: Сукиасян АА, к. э. н., ст. преп. – 2014. – С. 263.

A.B. Kamalov, S.A. Tursinbaev, Kh.M. Iliyev, M.M. Shoabdurakhimova. Influence of lighting on tenso-sensitivity of silicon doped with manganese. // Scientific-technical journal (Fergana). 2020, Vol. 3, No. 5. pp. 45–47.

Тазмеев Б. Х. и др. Изучение альтернативных источников электроэнергии в рамках курса физики // Материалы пула научно-практических конференций. – 2023. – С. 738-743.

D.M. Esbergenov, E.M. Naurzalieva, S.A. Tursinbaev, Enhancing the Perfection of a Silicon Crystal Doped with Nickel and Zinc Impurities. // East Eur. J. Phys. 4, 172 (2023), <https://doi.org/10.26565/2312-4334-2023-4-19>

Гринчук А. В. Опасность электромагнитного загрязнения окружающей среды // ISBN 978-5-7831-2032-9 © ФГБОУ ВО «Уфимский государственный нефтяной технический университет», 2020 © Коллектив авторов, 2020. – 2020. – С. 228.

Илиев Х. М., Камалов А. Б., Турсынбаев С. А. Кремний с нанокластерами атомов марганца-новый материал для тензодатчиков // НДПИ «Фан ва жамият» журналы. – 2020. – №. 4. – С. 7-9.

Hadzigeorgiou Y., Skoumios M. The Development of Environmental Awareness through School Science: Problems and Possibilities // International Journal of Environmental and Science Education. – 2013. – Т. 8. –

№ 3. – С. 405-426.

Зиятдинов Шамиль Габдинурович. // О содержании и структуре экологической составляющей школьного курса физики. Сибирский педагогический журнал, № 7., 2011, С. 181-188.

Boeve-de Pauw J., Donche V., Van Petegem P. Adolescents' environmental worldview and personality: An explorative study // Journal of environmental psychology. – 2011. – Т. 31. – № 2. – С. 109-117.

Бадёр М. П. Передача электрической энергии электромагнитными полями и их воздействие на окружающую среду // Электрификация транспорта. – 2016. – № 11. – С. 108-115.