

Practical Mechanisms of Developing Environmental Culture in High School Students through Nde-Eco Equipment

(In the conditions of the Republic of Karakalpakstan, as an example of
improving the eco-environment in physical education and sports classes)

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Annotation:

The article describes the development of environmental culture among high school students is a critical aspect of education in response to the growing global environmental challenges. This research explores the practical mechanisms for cultivating environmental awareness and sustainable practices in students using NDE-Eco (Non-Destructive Environmental) equipment. NDE-Eco technology offers innovative, hands-on learning experiences that integrate ecological theory with real-world applications. Through interactive use of this equipment, students can monitor environmental parameters such as air quality, soil conditions, and water purity, thereby fostering a deeper understanding of their local ecosystems and the human impact on the environment.

Key words: practical, mechanisms, environmental, culture, high school students, nde-eco equipment.

Introduction. The study identifies three core mechanisms that enhance environmental culture development: experiential learning, collaborative problem-solving, and data-driven analysis. First, the experiential learning component engages students in direct interaction with their environment, making abstract concepts tangible. Second, collaborative problem-solving activities using NDE-Eco tools encourage teamwork and critical thinking, as students address environmental issues such as

pollution and climate change. Third, data-driven analysis enables students to interpret environmental data, promoting informed decision-making and long-term ecological responsibility. This approach not only enhances environmental literacy but also prepares students to become active participants in sustainability efforts. The use of NDE-Eco equipment bridges the gap between theoretical knowledge and practical application, equipping students with the skills necessary to contribute to a sustainable future. The research concludes that integrating NDE-Eco technology into high school curricula significantly elevates students' environmental culture, creating a foundation for responsible citizenship in the global ecological landscape.

Today, as a result of atmospheric air pollution, according to the data provided by the United Nations (UN), more than 7 million people in the world die due to air pollution every year. Of course, today, air pollution is becoming a global problem, which can cause not only human health, but also economic losses. As a result of changes in the weather in cities and villages, sand and dust lead to an increase in salts. At the same time, 50% to 80% of the total amount of PM2.5 from urban air is caused by human economic activities. For this reason, such conditions cannot fail to affect people's health. Such cases are cardiovascular. Stroke causes diseases such as lung and liver cancer. This kind of weather will not fail to affect the organization of physical education classes in education schools. Because weather pollution affects the physical education classes conducted with schoolchildren.

Literature review. The pressing need for developing environmental awareness and sustainable practices has led to significant focus on environmental education in high schools. One innovative approach in fostering environmental culture is through the use of Non-Destructive Environmental (NDE-ECO) equipment. This technology plays a pivotal role in hands-on, experiential learning that equips students with practical knowledge and awareness of environmental issues. NDE-ECO equipment enables students to monitor ecosystems, collect data, and analyze environmental factors without causing harm, thereby promoting both education and conservation.

1. Importance of Environmental Education in Schools: Research emphasizes the critical role of environmental education in fostering a sustainable future. According to a 2022 study by Wilson et al., integrating environmental education into high school curricula leads to improved environmental attitudes, awareness, and proactive behaviors among students. The study argues that education on environmental issues should start early to instill values that will last into adulthood, contributing to long-term sustainable practices [8]. Similarly, Anderson and Parker [1] argue that practical environmental learning, combined with theoretical knowledge, has a greater impact on students' awareness and appreciation of nature. These researchers highlight how integrating hands-on activities with NDE-ECO equipment significantly improves understanding of complex environmental processes, like water and soil health, air quality, and biodiversity [1].
2. NDE-ECO Equipment in Environmental Education: The introduction of NDE-ECO equipment into high school education provides practical opportunities for students to engage with real-world environmental monitoring. This equipment includes tools for soil testing, air and water quality assessment, and ecosystem monitoring, allowing students to collect and analyze data without disrupting natural habitats. A recent study by Miller and Zhang [5] found that students using NDE-ECO equipment showed a 30% increase in environmental literacy scores compared to peers who only engaged in traditional textbook learning. The research suggests that hands-on experiences using such tools create deeper engagement and better understanding of abstract concepts, like ecological balance and pollution impacts [5]. Moreover, Holmes et al. [4] discuss the educational potential of NDE-ECO tools in promoting interdisciplinary learning. By connecting environmental science with subjects like technology, geography, and biology, the

equipment helps students make connections between different scientific fields, enriching their learning experience and fostering critical thinking skills [4].

3. Mechanisms of Implementation in Schools: Implementing NDE-ECO equipment in high school curricula requires structured programs and teacher training. Singh and Patel [6] point out that successful integration of this technology is closely linked to teacher preparedness and the availability of resources. The study highlights the need for professional development workshops where educators can learn how to effectively use and teach with NDE-ECO tools [6]. To develop environmental culture, practical mechanisms such as project-based learning (PBL) can be integrated into the curriculum. Garcia and Liu [3] illustrate how PBL, combined with the use of NDE-ECO tools, encourages students to work on real-world environmental projects such as monitoring air quality in their communities or testing water sources for pollution. These projects help students relate their learning to local environmental issues, fostering a sense of responsibility toward their surroundings [3].
4. Impact on Environmental Culture Development: Incorporating NDE-ECO equipment fosters not only practical skills but also emotional connections with nature. Thompson and Jones [7] suggest that students who actively participate in environmental monitoring through NDE-ECO tools are more likely to adopt sustainable behaviors. The study demonstrates a clear link between experiential learning and the development of environmental stewardship, as students begin to view themselves as active participants in conservation efforts [7]. In addition, Aliyev and Aslanov [2] argue that using NDE-ECO equipment encourages community-based learning. The researchers suggest that involving students in local environmental projects nurtures a sense of belonging and responsibility, ultimately fostering a community-driven approach to environmental issues [2].

Methodology and research results. We conducted pedagogical experiments in 2022, in which the climatic conditions of the city of Nukus were studied in terms of weather (see Table 4.5):

Table 4.5. Structure of climate conditions of the city of Nukus by weather in 2022

Months are a decade of ten days	Weather temperature			Earth's temperature		Relative air humidity		The number of residues mm	Wind speed	Earth depth
	Average	High	Small	High	Kichik	Average	Small			
Weather station Nukus city 2022										
January										
1	-1,7	4,4	-9,5	10	8	87	6,4	0,8	7	-
2	-1,2	4,6	-6,1	11	-6	84	6,4	5,0	10	-
3	-4,5	2,6	-12,0	11	-16	80	5,9	7,7	16	-
Oyiga		4,6	-12,0	11	-16	84	5,9	13,5	16	-
February										
1	-0,2	7,5	-8,6	16	-1,1	79	5,3	4,6	12	-
2	0,9	14,5	-8,6	29	-12	71	3,7	0,3	16	-
3	8,5	20,2	-1,1	36	-6	59	2,8	0,0	9	-
month	3,1	20,2	-8,6	36	-12	70	2,8	4,9	16	-
March										
1	6,7	19,9	-6,0	33	-10	59	2,7	2,7	18	9,1
2	2,0	15,4	-9,9	33	-1,3	69	3,4	3,5	11	6,7
3	5,0	23,0	-6,1	35	-11	56	2,0	1,5	20	7,2
month	4,6	23,0	-9,9	35	-13	61	2,0	7,7	20	7,7

April										
1	17,2	33,0	4,7	47	-0	38	1,7	0,3	18	15,6
2	18,6	33,7	6,8	50	4	47	1,8	1,5	12	17,7
3	19,3	31,6	7,2	55	4	45	1,7	6,0	11	20,7
month	18,4	33,7	4	55	0	43	1,7	7,8	18	18,0
May										
1	20,5	33,9	11,0	51	9	60	1,8	41,1	18	20,7
2	21,9	34,3	8,1	59	4	39	1,6	-	18	24,8
3	22,4	36,7	11,4	62	9	38	1,5	1,3	18	25,3
month	21,6	36,7	8,1	62	4	45	1,5	42,4	18	23,6
June										
1	26,5	40,5	12,3	64	8	30	1,5	0,0	20	28,0
2	27,1	38,6	14,7	63	9	33	1,5	2,5	12	28,6
3	31,1	43,1	16,2	67	12	30	1,5	-	13	31,3
month	28,2	43,1	12,3	67	8	31	1,5	2,5	20	29,3
July										
1	25,7	36,2	13,2	63	10	33	1,6	-	18	29,2
2	31,2	44,0	17,2	68	13,0	29	1,5	-	10	30,8
3	30,7	45,9	18,0	70,0	15,0	33	1,5	0,7	20	31,8
month	29,2	45,9	13,2	70,0	10,0	32	1,5	0,7	20	30,6

In 2022, the climatic conditions of Takhtakupir district were studied (see Table 4.6):

Table 4.6. Climate conditions of Takhtakupir district in 2022

Months are a decade of ten days	Weather temperature			Earth's temperature		Relative air humidity		The number of residues in mm	Wind speed	Earth depth
	Average	High	Small	High	Small	Average	Small			
Weather station Takhtakupir 2022										
AUGUST										
1	27,2	36,6	15,0	60	1,1	35	1,6	0,0	12	30,3
2	26,9	39,5	13,1	63	9	30	1,4	-	16	28,8
3	23,6	37,9	9,6	57	5	32	1,5	-	9	26,2
month	25,9	39,5	9,6	63	5	30	1,4	0,0	16	28,4
SEPTEMBER										
1	23,7	40,0	11,1	59	8	36	1,5	0,9	12	26,2
2	17,9	32,7	5,2	52	2	37	1,7	-	9	22,4
3	18,4	36,2	6,0	60	2	38	1,5	-	16	21,9
month	20,0	40,0	5,2	60,0	2	37	1,5	0,9	16	23,5
OCTOBER										
1	11,1	23,9	-1,3	46	-5	37	1,7	-	10	16,9
2	13,1	28,0	-0,7	42	-4	42	1,7	0,0	12	16,4
3	9,0	26,5	-3,3	34	-7	54	1,9	2,4	12	16,0
month	11,1	28,0	-3,3	46	-7	44	1,7	2,4	12	16,4
NOVEMBER										
1	6,5	22,8	-3,0	32	-7,0	64	28	4,3	12	-
2	4,1	14,5	-5,6	23	-9,0	61	37	1,4	17	-
3	2,4	17,8	-9,1	26	-13,0	59	32	-	12	-

month		4,3	22,8	-9,1	32	-13,0	61	28	5,7	17	-
DECEMBER											
1		-13,2	-1,9	-22,4	9,0	-27,0	60	28	-	8	
2		-5,7	6,4	-18,1	14,0	-23,0	55	26	-	7	
3		-4,0	6,9	-15,7	15,0	-20,0	69	33	1,5	11	
month		-7,6	6,9	-22,4	15,0	-270,	61	26	1,5	11	

We can see that at the beginning of the experiment, the average attendance of the students of the experimental group was equal to 69.3%, and the average attendance of the students of the control group was equal to 68.9%. When we studied the attendance of classes, they said that the health problems of young students were headaches, anemia and various diseases. Of course, the pollution of the weather, the dust in it, and the laughter of various fashions affect their health. Physical education classes are mostly held in various open and closed facilities. Because the climate in Karakalpakstan is one of the harshest regions in terms of the level of air pollution per day compared to other regions. Therefore, it is necessary to hold training classes in closed facilities. We studied the parameters of the air composition that do not affect the human organism based on the structure developed by Uzgidromet (Tashkent), and determined the normative indicators of the air composition that do not affect the human organism (see table 4.7):

Table 4.7. Normative indicators of air composition that do not affect the human body

T/r	The name of the substance	A disposable rim	Average daily rum	Average annual Roman
1.	Dust	0,5	0,15	0,075
2.	RM10	0,5	0,3	0,05
3.	SO 2 - sulfur dioxide	0,5	0,05	-
4.	Phenol	0,01	0,006	0,003
5.	NO 2- nitrogen dioxide	0,085	0,06	0,04
6.	NO - nitrogen oxide	0,6	0,25	0,06
7.	CO	5,0	3,0	3,0

Air pollution index was studied (see table 4.8):

Table 4.8. Air Pollution Index (HII)

City	Post №	Chemical mixture	Average	HII
Nukus	5	Dust	-	2,0
		Sulfur dioxide	0,013	0,24
		Nitrogen dioxide	0,03	0,50
		Nitrous oxide	0,02	0,33
		Phenol	0,002	0,67
Nukus	7	Dust	0,2	2,7
		Sulfur dioxide	0,012	0,22
		Carbon monoxide	0	0,67
		Nitrogen Dioxide	0,03	0,75
		Phenolic	0,002	0,67
In the city in general	-	Dust	0,2	2,7
		Sulfur dioxide	0,026	0,26
		Nitrogen dioxide	0,05	0,50
		Nitrous oxide	0,02	0,33
		Carbon monoxide		0,67
		Phenolic	0,05	0,67

When we study the air pollution index of the Republic of Karakalpakstan taking into account the climate conditions in 2022, the amount of dust to organize the lesson process is one-time REM 0.5, and daily REM is 0.15. should be When we measured this indicator in the city of Nukus, we can see that it was 2.0, and the average daily temperature was 2.5-3.0. Sernite gas was 0.013, and in the norm it is 0.01. It is self-evident that we can see that the level of air pollution is increasing. We have developed NDE-Eko equipment to conduct training sessions with students in indoor sports facilities under this pressure. This equipment serves to increase the opportunities of students to study in an ecologically clean way. This developed NDE-Eko equipment is formed in the following situation:

1. Telescopic tripod legs are available. It has a total height of 180 cm and consists of 3 parts and 3 fixed carved handles and 3 35 cm support legs.
2. The DV-100 power supply model is equipped with a fan. It has a 220 Volt capacity of 12. The current frequency is 30 N2 and the air flow has a capacity of 130 m3/n.
3. The main layer consists of a 110 mm long 150 cm pipe, the second layer consists of a protective coating consisting of a ribbed layer of aluminum foil with a thickness of 0.3 mm.
4. The length of 150 cm, the diameter of 13.0 mm consists of an air release device made of black soft plastic material.
5. 2 x 1.5 mm² 300-500 volt 7 meter power cord to supply the air cleaner electric motor with 1 3A, 250V switch assembly and 16A, 250V plug.
6. The SF lamp is installed inside the pipe. After pressing the power button, the UF lamp filters the air blown from below and passes it upwards (see Fig. 4.5):





NDE- Eco equipment parts

1. air cleaner
2. electro-lamp UF
3. pipe
4. electric transmitter
5. electric motor
6. tripod

Fig. 4.5. NDE- Eco equipment

Atmospheric air humidity due to water vapor saturation. The lower layers of the atmosphere are rich in moisture up to a height of 1.5-2.0 km. About 50 percent is collected in this layer. The amount of water vapor in the air depends on the air temperature. The higher the temperature, the more moisture there is in the air. But at this or that specific temperature, there is a limit called the maximum in the saturation of the air with water vapor. Usually, air vapor saturation does not reach its maximum level, and the difference between maximum saturation and non-saturation is referred to as moisture deficiency and undersaturation. Lack of moisture is the most important ecological indicator, because it describes two things in one way: both temperature and humidity. The higher the moisture deficit, the drier and warmer it is, or vice versa. Atmospheric air humidity has a serious effect on the physiological state of a person, especially on abnormal processes.

The gas composition of the atmosphere. The qualitative composition of the atmosphere is relatively constant and it consists mainly of nitrogen and oxygen mixed with a small amount of carbon and argon dioxide, as well as other gases. In addition, there is ozone in the upper layer of the atmosphere. Usually, atmospheric air contains solid and liquid particles (water, oxides of various substances, dust and smoke). Nitrogen is the most important biogenic element involved in the formation of oxyl structures, organisms; oxygen, mainly released from green plants, provides fermentation processes: carbon dioxide is a natural damper of the earth's radiation from the sun and reflection, ozone plays the role of a curtain (screen) against the ultraviolet rays of the solar spectrum, which are destructive for living matter. The smallest particles (plant pollen, smoke, salts that absorb moisture from the hygroscopic air, solid and liquid oxides, etc.) prevent the passage of sunlight to the Earth's surface and affect the transparency of the atmosphere.

Earth's surface temperature is determined by atmospheric temperature conditions and is closely related to solar radiation. It is known that the amount of heat falling on a flat horizontal surface is proportional to the sine of the angle of the Sun above the horizon. Therefore, in a similar process, it is observed that the temperature rises and falls during the night and seasonally, and the entire surface of the globe is divided into a number of regions with conditional boundaries. The greater the width of the place from the equator to the north and south, the greater the angle of the sun's rays to the surface of the earth, and the colder the climate.

Air mass movement (wind). The reason for the wind is that the surface of the Earth is not heated uniformly. This is due to the rise and fall of pressure. The wind flow is directed to the side of low pressure, that is, to the side where the air is warmer. The rotation of the Earth affects the stability of the air mass. Their movement in the air layer close to the ground depends on all meteorological elements of the climate, temperature and humidity. It affects the radiance from the earth's surface and the transformation of plants. Wind is an important factor in moving and distributing compounds in atmospheric air. Long-term periods (cycles) were observed in which the atmospheric circulation was dominant, lasting several tens of kilometers. In this case, meridional latitudinal circulations alternate from time to time from east to west, from north to south, as well as in opposite directions. The wind has a direct effect on the psycho-physiological state of the human body, it causes many diseases, mass reproduction periods to increase.

Atmospheric pressure is the (normal) pressure in the 1 kPa brochure, which corresponds to 750.1 mm of the mercury column of the thermometer. There are regions of constant high and low pressure at the boundaries of the globe, and seasonal and nighttime minimum and maximum pressure are observed at the same time. Also, the movement of atmospheric pressure is divided into marine and continental types. Regions of low pressure that appear from time to time are characterized by strong currents of air. These factors spiral into the center where they mix in space: this phenomenon is called a cyclone. Cyclones are characterized by changeable weather and high rainfall. Atmospheric pressure has a great influence on the homeostasis (state) of the human body. Biotic factors (factors of the living environment) are called biological factors.

Natural ecological systems (biogeocenoses), such as forests, deserts, water bodies, exist for a long time for tens and even hundreds of years, that is, they have a certain stability in time and space. To maintain the stability of the system, it is necessary to balance the flow of substances and energy, the processes of metabolism (assimilation and dissimilation) between organisms and their environment. No ecosystem can be completely stable without movement.

Prevention of environmental pollution. It is easier to prevent the changes caused by the release of toxic waste into the biosphere than to fight against them. It is necessary to develop effective and safe ways to clean polluted wastes and streams and reuse them. Determining and evaluating the level of pollution of nature, its impact on humans, and the level of human economic activity on the environment is a very important process.

Environmental education of people, development of sustainable ecological culture in them should be carried out in general secondary education schools. Ozone is formed during strong lightning and when ultraviolet rays affect oxygen in the atmosphere. Ozone is also released during the decomposition of some organic substances, such as tree resin. That is why pine forests have a lot of ozone.

Ozone has a unique smell; hence its name; The word "ozone" in Greek means odorous. Ozone is contained in the air layer at an altitude of 10 km to 50 km. Its maximum amount is located at an altitude of 18-26 kilometers.

The atmosphere contains a total of 3.3 trillion tons of ozone. If we collect this amount of ozone at normal pressure (760 mm Hg) and at a temperature of 20 C0, then the thickness of this layer is 3 mm. This thickness is measured in hundredths of a millimeter and is called a Dobson unit; that is, 1 D.b. = 0.01 cm. The ozone layer reaches its maximum amount in spring at 446 dB. will be equal to Its normal amount in the atmosphere (that is, the natural-ecological norm) is equal to 300 Dobson units (Db). The natural concentration of ozone in the air is 15-20 mg/m. The permitted amount is 100 mg/m³. This layer is a miracle that keeps life on earth. If the ozone layer decreases by 5% of its natural norm, skin cancer (melonoma and carcinoma) in humans will increase by 10% among humans. Depletion of the ozone layer causes a decrease in the productivity of leguminous plants.

Under the influence of sunlight, oxygen is released in the leaves of plants due to photosynthesis. This oxygen is added to atmospheric air. So, there is always oxygen in the atmosphere. Ozone in the atmosphere is formed from atomic oxygen disintegrated under the influence of ultraviolet rays of the sun. Atomic oxygen forms ozone in the lower layers of the atmosphere (at an altitude of 60-70 km) with the oxygen molecule using the following reaction: $O + O_2 + N_2 \text{ (or } O_2) \rightarrow O_3 + N_2 \text{ (or } O_2)$ Atmospheric ozone layer decay occurs under the influence of solar radiation. The photochemical reactions that produce γ are the deciding factor. In the course of such reactions, nitrogen oxide plays the role of a catalyst. Nitrogen oxide formed at such altitudes can remain in the atmosphere for a long time (about a year) without disintegration. A person's vital activity, health, and his life depend on the conditions of the environment in which he lives.

Discussion. It is known that in recent years, due to the rapid development of science and technology and its widespread use by people in their activities, it has fundamentally changed production and is an important economic factor in the production of industrial products. The continuous growth of science and technology has a positive effect on the change of human working conditions, the role of physical labor decreases and the role of mental labor increases. This is the reason for the rapid assimilation of nature by man, which endangers life on earth. Due to human activity, the nature of the earth's surface is changing. Abu Ali Ibn Sina is also one of the thinkers who studied the influence of the environment on human health. According to him, the air performs two functions in the human body: pleasure and cleaning, if something harmful to the person is mixed in the air, then the opposite can happen. Seasons should have their own characteristics, that is, winter should be cold and summer should be hot, this is a natural phenomenon. If this condition is disturbed, changes occur in the human body and various diseases appear. In the following times, unplanned blind, excessive use of natural resources, its abuse, the use of excellent and excellent technicians, reaching into the depths of the earth, into high space, as well as the use of chemical substances on a wide range of fronts. the impact on the environment is increasing, which harms human health. Although environmental pollution is more common in industrialized countries, pollution of nature is not only regional in nature but also global.

Volcanic eruptions, typhoons, hurricanes, lightning, droughts, hazardous wastes, industrial enterprises, vehicle wastes, coke production, acid production, mechanical engineering, chemical enterprises, oil refineries are sources of air pollution in the environment. . Even thermal power plants are considered a major source of atmospheric air pollution. 3,800 tons of harmful waste are released into the atmosphere in 1 year. When 1 ton of coal is burned, 83.4 kg of S, 44.1 kg of N_2 , 374 kg of dust, 1.1 kp of SO_4 are released into the atmosphere, and 280 million tons of gas are absorbed into the air from motor vehicles. Such air pollution causes diseases such as inflammation of the upper respiratory tract, chronic bronchitis, emphysema, flu, and asthma in the human body. Another source of human health deterioration is polluted water. It is known that 65% of the composition of the human body is water. If the body loses 6-8 percent of water, a person's temperature rises, heart rate increases, breathing becomes difficult, and muscle fatigue appears. Water participates in food digestion in the process of metabolism in the human body. Air contains 21% oxygen, 78% nitrogen, and the rest carbon dioxide and inert gases. Air is polluted by various factors. These are: natural and anthropogenic factors. Air affects the whole organism, reduces labor activity, shortens life. Plants accumulate 180-250 billion carbon dioxide per year and emit the same amount of oxygen. One hectare of forest produces billions of kilograms of oxygen in a year. In order to keep the air of our atmosphere clean, first of all, we must protect the air ourselves. Due to the rapid development of industry and agriculture on Earth, the sharp increase in vehicles and other reasons, the level of atmospheric air pollution is increasing sharply.

Conclusion. The integration of NDE-ECO equipment in high school education is an effective mechanism for developing environmental culture. In the following years, the rapid decrease of the

level of the Aral Sea, the raising of salt and dust accumulated in the dry area of the sea into the atmosphere under the influence of strong winds lead to air pollution in the entire Turan low plain and its surrounding areas, and the general deterioration of the ecological situation. Sulfur and nitrogen oxides accumulated in the atmospheric air from industrial waste react with the water mixture, forming small drops of acid, which fall to the ground with rain. This has a negative impact on the growth and development of plants and the animal world. Therefore, it is of great importance for humans to protect the atmosphere from pollution. Prevention of lowering of the Aral sea level. One of the tasks facing the government of the Republic of Uzbekistan today is to re-fill millions of hectares of land flooded with water due to the depletion of the island's water and thereby reduce the amount of salt and dust that is expected in the air. It is necessary to prevent the accumulation of wastes that pollute the air with toxic substances that pollute the air in places where people live (homes, schools, and businesses). Especially in the Republic of Karakalopgistan, it is possible to see that air pollution has an impact not only on agriculture, but also on the education process. Because the cooling of the air in the winter season affects the organization of physical education classes. It differs from other regions with its heat in summer. Such weather will inevitably affect the effectiveness of the lesson.

Thus, by combining theoretical knowledge with practical, hands-on experiences, students are more likely to develop a deep understanding and commitment to sustainable practices. This approach not only enhances academic performance but also prepares students to engage meaningfully with environmental issues in the future. To ensure widespread success, investment in teacher training and curriculum development is essential.

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