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ENVIRONMENTAL EDUCATION OF SCHOOLCHILDREN BASED ON THE STUDY OF ENVIRONMENTAL PROBLEMS

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Abstract

The article examines the impact of project activities on the study of environmental issues in the region on the formation of environmental knowledge and research skills through the project activities of schoolchildren. The role of the regional component in choosing the content of the project activities of pupils and students is substantiated from the standpoint of understanding the social significance of environmental research, the acquisition of research experience by participants in environmental projects, the formation of environmental literacy, reflected in the comprehensive coverage of various factors affecting the region state of the environment. School children from three regions took part in the project activities: the Republic of Kalmykia, the Astrakhan Region, and the Khabarovsk Territory, conducted under the guidance of graduate students of the Department of Chemistry of the Kalmyk State University as part of the educational project “Point of Growth”, the National Program “Education” for rural schools and small towns of Russia, as well as the Priority Program for the study of the ecological state of the region. The article gives a general analysis of the content of projects, the project method, experimental in the nature of the activity and instrumental in implementation, interdisciplinary in content, and social in direction. Involving school children in the study of regional environmental issues contributes to the functionality of the acquired knowledge and creates the basis for environmentally justified behavior.

Keywords: Environmental education, ecological culture, project activities, regional component

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1. Introduction

Environmental education is an important component of ecological culture that plays a worldview role, capable of changing the position of a person as standing above nature to the position of a person as a part of it (Martinovich, 2017). The philosopher Moiseev (1988), influenced by the ideas of Vernadsky, put forward the idea of an environmental imperative as a requirement and condition for the further development of mankind, the need to restructure human consciousness to preserve nature. In psychology and pedagogy, environmental education and upbringing are considered a condition for the formation of environmental thinking and ecological culture; in pedagogy, environmental education and upbringing are also studied as components of functional literacy and the basis of environmentally justified behavior (Zakhlebny & Dzyatkovskaya, 2017). In society, the problems of environmental conservation acquire a global character, go beyond socially oriented and economic problems, and become a significant factor in human survival. The ideas of "green chemistry" are being introduced into human production and technological activities, the number of supporters of the Green Party is increasing in society and politics, and research on environmental monitoring is being strengthened.

The problem of environmental education is global, affecting many states, mainly among economically and technologically developing countries. Every year since 1997, the National Environmental Education and Training Foundation (NEETF) in the US has conducted a national survey of adult environmental knowledge, with poor results. The growing complexity of many environmental issues, including energy, requires the implementation of environmental education programs and the improvement of the effectiveness of other existing programs (Carleton-Hug & Hug, 2010). Today, countries that want to get ahead in the technological race, under pressure from social-environmental movements, are trying to find technologies that do not harm the environment. The rules that most countries must obey have been announced at many meetings where environmental issues are discussed (Mustafa, 2012).

In the domestic education system, the environmental component is included in the content of academic subjects, especially the natural science cycle, as well as in the form of an independent discipline. Researchers distinguish environmental literacy as a component of the functional literacy of school children (Zakhlebny & Dzyatkovskaya, 2017). Under the influence of a global environmental issue caused by an increase in anthropogenic pressure on nature, with a change in types of economic activity and the depletion of natural resources, climatic and other changes, the relevance of project research activities of students, contributed to the formation of ecological culture, increases. In everyday life, people are faced with environmental problems, with the problems of maintaining health in a deteriorating environment, which forces them to change their previous ideas about nature as an inexhaustible "pantry" and "workshop", where "a person is a master" (Oleynikov, 2006). The structure of ecological culture includes such components as a system of environmental knowledge, environmentally justified behavior, and a consciously valued attitude of a person to the world around him. An important role in the formation of environmental knowledge is assigned to the school education system through the introduction of research methods in the process of implementing environmental and social educational projects.

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The introduction of the regional component into the content of environmental education projects shows the importance of environmental issues through a detailed study of the chemical composition and state of local natural objects, putting forward the causes and consequences of pollutants. The ongoing chemical analysis of the composition of pollutants shows ways to identify them qualitatively and quantitatively (Khochaeva & Vasilyeva, 2018). In the recent past, a small number of students motivated to study the natural sciences participated in project activities. The involvement of an increasing number of school children in research became possible due to the implementation of the state strategy for the development of science education, for the dissemination of research skills of students at all levels of school education, including schools in small towns and rural schools, within the framework of the national project “Education”. Identified schools with the high innovative activity of teachers and schoolchildren become centers of the “Growth Point” for the research activity of children.

Environmental research projects based on the analysis of the region's natural environments are important for environmental education and upbringing. Schoolchildren's research is not aimed at solving global issues, designing and planning economic and production activities, but to achieve an understanding of the reality of environmental threats by each project participant. In innovative educational institutions, conditions are created for the implementation of research projects for schoolchildren. Participation in such research projects provides an opportunity to study the nature of pollutants, their origin, and distribution. In educational tasks, regardless of the production environment, the formation of ecological culture and environmental behavior is manifested in socially significant measures to improve the environment. An integrative approach to the formation of environmental literacy in the process of implementing the projects requires considering the multidimensionality of the causes of the occurrence of geological, biological, social, and production factors that affect the environmental state of the region. Regionalization of research activities in ecology, generalization, and systematization of the results obtained at the level of local territories are manifested at the level of social projects and environmental protection measures. Environmental projects in the education system and research results should be studied at the subject and interdisciplinary levels, considering the complexity of the impacts of pollutants on the environment.

2. Problem Statement

The content of the regional component of environmental projects has invariant and variable components. The invariant part is based on the analysis of the parametric characteristics of the region, the criteria for the implementation of the research project, the identification of the content, methods for achieving the goals, and the complex nature of the object under study. To describe the parametric characteristics of the region, scientific research was used to identify region environmental issues (Buluktaev, 2018a). The invariant part includes a system of methods for qualitative and quantitative analysis of the composition of pollutants to objectively assess environmental threats. As part of the pedagogical justification for planning and implementing research activities, a system-activity approach and integrative components were used to form environmental literacy as part of functional literacy. The problem of revising attitudes towards environmental education in the world and the country is acute and

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largely unexplored in terms of the transformation of environmental knowledge into environmental beliefs and environmentally oriented behaviour.

The variable part of the ongoing projects is the subject of the study (objects of the natural and industrial environment), the content of the study, and its social orientation. For the purpose of the article, it was relevant to identify ways to implement the ideas of “Green Chemistry” in environmental projects and its twelve rules in understanding the prevention of future environmental crises.

The problem of forming an ecological culture through ecological knowledge and research activities involves the organization and involvement of schoolchildren and students in the implementation of project activities. Upon completion of the projects, a comprehensive review of the development of environmental knowledge, the level of formation of environmentally oriented behavior, and readiness for environmentally oriented activities are planned. Since culture is a specific sphere and form of activity associated with thinking, accepted code of conduct, and social regulation, it seems important to consider the ethnocultural traditions of the peoples inhabiting the region. In the future, the historical roots of the careful attitude to nature of the peoples living in the region will be studied in folk pedagogy.

3. Research Questions

The study of the region's environmental issues as the basis of environmental education and upbringing should be carried out taking into account the experimental nature of environmental projects. For the invariant part of the study, the parametric characteristics of the region were reviewed to identify the object of study, the formulation of tasks, and the selection of methods for experimental work. The features of the ecological state of the natural environments of three regions, and methods for determining the composition of the major pollutants, their origin, and accumulation in natural environments are highlighted. A brief analysis of the topics of research work of pupils and students is given.

The description of the parametric characteristics of the region for environmental research defines the invariant part of the research, methods, means, goals, and tasks.

The Republic of Kalmykia is characterized by a hot climate and desertification of part of its territory; among the environmental issues, the most acute problem is the high salinity of local waters and soil pollution with oil products in the eastern part of its territory (Buluktaev, 2018b). Since the region is located in the zone of the Caspian lowland and surrounded by industrialized centers, this factor explains the presence of heavy metals in natural waters and soil cover. These and other factors require environmental monitoring.

Methods and instrumentation for monitoring. In 2021, Kalmyk State University named after B.B. Gorodovikov was among the 121 universities in the country for the implementation of the Federal Program “Priority 2030”, one of the areas of which is a project to preserve biological diversity. One of the project's main tasks is the development of an atlas of the Republic of Kalmykia based on GIS technologies to study environmental problems. Within the framework of the project, it is planned to create an international youth center for monitoring and protecting the environment and a network of volunteer centers to solve environmental problems in the region. In Kalmykia, the issue of oil pollution in part of the territory is acute; the state of soils and groundwater is being monitored for the analysis of pollutants by instrumental methods.

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The Kamchatka Territory has a high potential for aquatic and biological resources, providing about 22.0 % of Russian fish and seafood production and about 18.7% of the production of marketable fish food products. The quantity of fish in the rivers of the region depends on the quality of the water. The historical formation of most settlements in the region is territorially tied to a water body since the indigenous peoples of the north needed a source of drinking water and fish as a traditional food resource. As an example, we present the results of one of the school studies.

The current ecological state of the basin of the Tikhaya and Pervaya rivers in the Elizovsky district causes concern among the villagers, the cause of which is worn-out treatment facilities. An initiative group of school children carried out the activities to study and improve the water system. Monitoring of the state of the environment of the village revealed reserve sources of drinking water. The theme of the research work of school children is “Studying the water quality of the First River flowing near the village of Nikolaevka.”

Study of the microbiological indicators of the water of the First River for its use as a reserve source of drinking water.

The study was based on the water samples analysis from the First River. Organoleptic and microbiological indicators were studied. Samples for organoleptic indicators were carried out by GOST R 51232-98 and GOST 31861-2012. Sampling for microbiological analysis was performed following GOST R 53415-2009 (ISO 19458: 2006). In addition to the analysis of water samples, the methods of sociological research of the inhabitants of the village were used in the study to obtain primary information about the problem and a comparative method to study the problem in dynamics. The results are presented below.

1. Comparing the organoleptic characteristics of the samples, it was noted that, as in 2017, the water from samples No. 1 and No. 2 (treatment facilities and water at the place of discharge into the river) does not meet the requirements of GOST and the Sanitary Rules and Norms.

2. The results of the microbiological study of water samples and their comparison with the results of 2017, samples No. 1 and No. 2 worsened their indicators.

3. Thus, it can be concluded that four years after the first sampling, the water quality at the discharge point has only worsened.

4. Indirectly, the deterioration of water quality can be judged by the decrease in the number of fish in the river, which was also noted by residents.

5. Based on the foregoing, the hypothesis about the use of the First River as a reserve source of drinking water has not been confirmed.

The Nikolaevsky district of the Astrakhan region is characterized by its territorial proximity to chemical, petrochemical, and processing industries. This makes it possible to study their impact on the environment from the standpoint of Green Chemistry. The study of the ecological state of the region in a rural school was facilitated by the development of the elective course “Green Chemistry for Life”, the experience of the teacher, one of the authors of the article in the Regional School Technopark, the study of the ideas of Green Chemistry in the exploring chemical production, as well as the educational achievements of students.

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Residents of small towns experience the impact on their health of pollutants from the operation of outdated technologies of local industries. The task of the school environmental project was to study the activities of the local fishing enterprise in waste disposal, and analysis of soil pollution around the repository and wastewater. The analysis of the ecological conditions of the regions revealed the composition of pollutants from surfactants, disinfectants, and an increased level of salt content in the wastewater. The results of the study were reflected in the media, and the territories adjacent to the production were cleaned. The schoolchildren's research project revealed the dependence of the ecological state of the environment on human economic activity.

Research methods and instrumentation were similar in school laboratories due to the Point of Growth program in the Kamchatka Territory and Astrakhan Region, as well as the involvement of instruments and equipment from local SES. The study of the ecological state in the Republic of Kalmykia was carried out due to the BioVet complex analytical laboratory, which monitors the environment. The laboratory is equipped with modern analytical equipment, which is used to study the region's environment and its pollutants. Pupils from different schools have the opportunity to do part of their study, expand their environmental knowledge, and learn more about the region's problems.

4. Purpose of the Study

The aim of the article is to increase the level of environmental education for school children by studying the environmental problems of the region. To do this, it is necessary to analyze the content of ongoing projects devoted to the study of environmental problems in the region, select experimental research methods, organize the search activities of students, to identify the general and specific in the structure and content of environmental projects in different regions and the results of the participants' project activities.

5. Research Methods

The involvement of schoolchildren in an environmental study is determined by dynamic indicators: The number of participants in projects, the success of submitted projects at competitions at the school and municipal levels, and the attitude of participants to the results of the study using a questionnaire and express survey. The level of environmental education of project participants is planned to be assessed according to the following criteria: Availability of a system of environmental knowledge, the presence of environmentally oriented activities, the development of individual characteristics of the student's environmental consciousness, the identification of meaningful and valuable results of participants in project activities based on school continuity.

The university used atomic absorption analysis for determining heavy metals in soil, a fluorometric method for determining oil products in natural objects, a titrimetric method for determining hardness, a permanganate oxidizability method, and a potentiometric method for determining the environment of the studied objects. Innovative schools used qualitative and quantitative analysis, and titrimetric methods for solution analysis, and also had instruments and reagents provided by the Growth Point program and the Releon lab digital laboratory.

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6. Findings

Environmental education and upbringing of schoolchildren in the course of project work on the ecological state of the region have increased significantly. Study work with participants in project work was reflected in publications in conference proceedings; the number of participants in project activities has increased due to the implementation of the Point of Growth project, among the two regions there are finalists in competitions at the municipal level. The scope of environmental projects has expanded by providing the possibility of instrumentation.

Among the results, one should also note the interest in the implementation of experimental work, positive feedback on the study process, and participation in environmental events and environmental volunteering. The coverage of the results of the environmental study carried out is reflected in the local media, and social networks and is approved by the local population. The results obtained during the implementation of the Federal program “Priority”, upon completion of the project, will be highlighted on large information platforms and will become available to the population of the region.

7. Conclusion

Summing up the results, it can be concluded that the study of the region's environmental issues as the basis of environmental education and upbringing should be carried out taking into account the experimental nature of environmental projects. For the invariant part of the study, the parametric characteristics of the region were reviewed to identify the object of study, the formulation of tasks, and the selection of methods for experimental work. The features of the ecological state of the natural environments of three regions, and methods for determining the composition of the major pollutants, their origin, and accumulation in natural environments are highlighted. A brief analysis of the topics of research work of pupils and students is given.

The purpose of the article is the development of environmental education for school children and students through the study of regional environmental problems will allow all participants to assess the importance of solving environmental issues, and develop a caring attitude toward the nature of their native land.

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