

# "Space Monitoring" as an Element of Environmental Education

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**Abstract**—Currently, environmental education and upbringing are one of the current trends in the development of education and upbringing systems in general. Without environmental education, it is impossible to form public ecological awareness. This paper focuses on the training of professors in the "Space Monitoring" profile. It is shown that graduates of this field of study possess both knowledge, skills, abilities and competences in the field of the professional-pedagogical activity, and in the subject area related to environmental monitoring by means of space-based facilities. The elements of the study plan for the preparation of bachelors in the direction of "Technical training (by industry)" and examples of final qualifying works, demonstrating the universal comprehensive training of professors in the field of space monitoring and environmental education are presented. It was concluded that this approach to education forms the ecological world outlook of graduates and makes it possible to transmit their knowledge through pedagogism, thereby prolonging environmental education to the next generation.

**Keywords**—environmental education and upbringing; space monitoring; spacecraft; environment; ecosystem; pedagogical activity; professional education; higher education; secondary vocational education

## I. INTRODUCTION

In the modern ecological situation, an important issue is to teach the younger generation a conscious attitude towards the conservation of nature, human activity, the existence of the planet and the ecological world around it. The knowledge of the objective world is impossible without the knowledge of the ecological connections that really exist in it. It solves the problem of environmental education, striving within different disciplines, training areas and specialties to develop students' ecological knowledge and skills, forming the ecological culture [1] among young people.

One of the most important principles of environmental education should be the principle of continuity — an interrelated process of learning, upbringing and developing a person throughout his life. Now life sets before the educators, teachers, and professors the task of developing the student's personality as a continuous process.

In the XVII century, John Amos Comenius [2] drew attention to the natural conformity of all things, i.e. to the fact that all processes in human society proceed like processes of nature. From here, he deduced the laws of learning and upbringing, based on the principles of nature conformance.

Consequently, the solution of ecological problems should be sought in the field of culture of nature management of people, in the formation of new systems of consciousness and behavior, in changing the content of interests, norms, values, and knowledge related to the interaction of society and nature.

Thus, environmental education should become not only an integral part of educational programs at all levels of education but also of all forms of social influence on the development of public conscience and human behavior. Moreover, there is a need to train teachers and professors who are able to train the next generation in understanding the unity of the environment and the human impact on nature.

## II. "SPACE MONITORING" — PROFILE OF PEDAGOGICAL EDUCATION

In the Mytishchi branch of Bauman Moscow State Technical University implemented the direction of training of bachelors "Technical training (by industry)", which graduates specialists-professor for secondary vocational and extended professional education in various industries and economics.

Four years ago, the educational program "Space Monitoring" was developed. In turn, space monitoring has become almost a separate branch of science and technology, including a system of regular observations and monitoring of the state of the environment, territory, Earth, analysis of current processes and trends in the development of situations by means of space-based facilities. In addition, space monitoring involves not only monitoring the process or phenomenon, but also assessing, forecasting, and then developing a system of measures to prevent dangerous consequences or maintain favorable trends.

Thus, space monitoring becomes a means of control and ensures, among other things, management decisions related to the assessment of a threat to human health; the effects of global air pollution on climate; critical issues arising from agricultural activities and land use; reactions of terrestrial ecosystems to environmental effects; assessment of ocean pollution and the impact of pollution on marine ecosystems, as well as the creation of a warning system for natural disasters on an international scale.

The main purpose of monitoring is to monitor the state of the environment and the level of its pollution. It is equally important to assess in a timely manner the consequences of the anthropogenic impact on the biosphere of the ecosystem and human health, as well as the effectiveness of environmental protection measures [3]. But monitoring is not only tracking and evaluating facts, but also experimental modeling, forecasting, and recommendations for managing the state of the environment.

Consequently, space monitoring is an essential part of ecological control, which is carried out by the state and the world community as a whole.

However, no one prepares specialists in integrated space monitoring. There is separate training for the development of spacecraft (including satellites, spacecraft, launch vehicles, etc.); separately - specialists in aircraft control systems (orientation and navigation devices, sensors, antennas, etc.); separately - by information technology (pattern recognition, methods of information transmission, etc.). There is also a training of specialists in geodesy and cartography, aerial photography, who can read the obtained images to determine the data, characteristics, and parameters of the situation under study. In addition, we must not forget about the object environment - specialists in forestry, landscape, engaged in tracking, care, and protection of forest and park areas; river economy, marine sphere - biologists, hydrologists, oceanologists and other specialists.

And completely individual experts are ecologists, and even here they differ in training profiles, for example, Technogenic Safety, Engineering Environmental Protection, Safety in Emergency Situations, Non-Traditional and Renewable Energy Sources and Resource Conservation, Integrated Use of Water Resources, Analysis and Management of Man-Made and Natural Risks, Habitat Acoustics, Physico-Chemical Technologies for Protecting the Atmosphere, Engineering Methods for Ensuring Industrial Safety, Fire and Industrial Safety, etc.

All these specialists are necessary for the growing trend of universal environmental education.

Environmental education is purposefully organized, systematically and systematically carried out the process of mastering the ecological knowledge and skills [4]. Environmental education was put forward by UNESCO and the United Nations Environment Program as one of the main means of harmonizing the interaction between man and nature. The decree of the President of the Russian Federation "On the state strategy of the Russian Federation on environmental protection and sustainable development" as one of the most important areas of state policy in the field of ecology has marked the development of environmental education and upbringing. A government decree has set up an Interdepartmental Council on environmental education. State Duma of the Federal Assembly of the Russian Federation adopted the Federal Law "On State Policy in the Field of Environmental education".

Environmental education in modern conditions is designed to promote the formation of a new ecological consciousness among people, to help them in assimilating such values, professional knowledge, and skills that would contribute to exiting the ecological crisis and moving society along the path of sustainable development.

The current legislation proclaims the universality, complexity, and continuity of ecological upbringing and education. The principle of universality means that environmental education and upbringing should encompass all members of society, teaching ecological disciplines should be carried out in all educational institutions for the younger generation, and for people of an older age should be organized a targeted process of education by the media and public ecological organizations.

Under the complexity should be understood the interdependent and interrelated process of ecological upbringing as a single holistic system, covering the economic, social, scientific, technical, ecological, legal and other aspects of education.

The principle of continuity stems from the fact that upbringing is a multifaceted and multifactorial process, which is not limited to either time or age, begins in educational institutions and continues throughout life, affecting the social and professional activities of the individual, the formation of its certain qualities, values, rights and obligations [5].

Thus, the actual for the development of environmental education is the training of specialists who possess not only the knowledge, skills, and abilities of the professor, but also possess the subject area related to environmental protection, and that is especially valuable, means and tools of ecological monitoring. Such specialists, in our opinion, are the professors of the "Space monitoring" profile.

### III. REALIZATION OF ENVIRONMENTAL EDUCATION THROUGH PROFESSOR TRAINING

As part of the preparation of bachelors in the field of "Technical training (by industry)", the educational program "Space monitoring" was developed.

In accordance with the Federal Law "On education in the Russian Federation" (Federal Law dated December 29, 2012, N 273-FZ), vocational training is understood as the following: a type of education aimed at acquiring students with the knowledge and skills necessary to develop competencies certain labor, official functions (certain types of labor, official activities, professions) (Art. 2, p. 13).

Training specialists in higher education in this area involves the following area of the professional activity of graduates: education and science (in the field of vocational training, professional education, and extended education) (Federal State Educational Standard of Higher Education (FSES) No. 124 dated 22.02.2014). Professional activities: training of students in professions and specialties in educational institutions that implement professional educational programs, secondary vocational and extended professional education, educational networks of enterprises and organizations, in centers for training, retraining and advanced training of workers, employees and mid-level specialists, and also in the Public employment service (FSES No.1085 dated 10.01.2015).

Consequently, graduates of this direction are teachers, lecturers and professors, training mid-level specialists, starting with primary education (colleges, technical schools), including extended education (pre-university training, thematic sections, vocational guidance, etc.), and continuing for adults — employees of enterprises (as part of staff retraining, extending qualifications), as well as retraining in employment centers [6].

The study plan and educational system are structured as follows:

The part of the education is the preparation of the professor, pedagogical education, which includes the following disciplines: Introduction to professional and pedagogical activity, Age physiology and psychophysiology, General psychology, Vocational training methods, General and professional pedagogy, Pedagogical technologies, Psychology of professional education, Methods of educational work, Social Pedagogy, Practical (industrial) training, Pedagogical management, Psychology of communication, Rhetoric, Technology development of educational software and educational documentation, Pedagogical skills, Pedagogical design;

The part of the education is the subject area related to space monitoring of forest stands and environmental education, including the following disciplines: Technologies for Using the Results of Space Activities, Law, Computer Technologies in Science, Education and Production, Life safety, Forestry, Automation of forest maps, Taxation and forest management using geographic information system (GIS), Forest resource monitoring, Landscape science with basic land management, Forest inventory using GIS,

Geodesy and cartography in GIS, Geoinformatics, Basics of GIS, Statistical analysis spatial data, Forest ecosystem modeling, Automation of decoding of remote sensing data, Photogrammetry, Forest sector economics, Forestry, Land law, ecological law of the Russian Federation.

Being educated in two areas of professional activity, the graduation thesis also always consists of two parts: the first is research related to space monitoring; the second is the development of a training session based on the data and the results obtained of the first part.

In performing the first part of the graduation thesis, special attention is paid to the study of means, methods, techniques, tools for monitoring the state of the natural environment from space. The basis of the findings is the study of the ecological state of the Earth, the ecological parameters of the ecosystem, such as: temperature regimes of the ocean, continents, atmosphere at different levels; study of the phenomena of soil degradation; study of the dynamics of forest areas, forest and steppe fires; research of all types of pollution of the atmosphere and hydrosphere; the study of volcanism and their effects on the state of the ecosystem, etc. Space monitoring allows to quickly identify the foci and nature of environmental changes, track the intensity of processes and the amplitudes of ecological shifts, study the interaction of man-made systems.

In performing the second part of the graduation thesis, the obtained knowledge of the teaching methods, techniques, and means of education, the development of teaching materials, didactic principles implemented in the classroom are used, and a discipline passport, a methodical study of the lesson, an example of its implementation are drawn up.. Laboratory work, a practical lesson (seminar), a professional orientation lecture, a thematic lesson, etc. can be such an educational lesson. For the most part, graduates focus on the specialties of secondary vocational education, their federal state educational standards, study plan and list of subjects taught.

Examples of graduation thesis themes are: "Investigation of the dynamics of areas of forest land based on multi-zone data and the development of methods for teaching a training session on the subject Monitoring of forest resources"; "Creating a taxonomic base for the implementation of ecological assessments on the basis of the results of the thematic space image classification and development of methods of teaching of the lesson on discipline" Automation of decoding data of remote sensing of the Earth "; "Creating an orthophoto map using a multi-rotor unmanned aerial vehicle using mobile reference signs and developing a methodology for teaching a training session in the discipline "Photogrammetry"; "Using the dense cloud technology for processing data from an unmanned aerial vehicle and developing a teaching methodology for a training session in the discipline "Stereotopographic Survey".

Consequently, the pedagogical activity of the graduate acquires a system-holistic nature. The teacher with the "Space monitoring" profile owns not only the field of professional-pedagogical activity, based on knowledge and skills on how to carry out the future educational process that

has not yet been realized, but also the subject area as a specific area of culture to which he is ready to introduce his students, including in the field of environmental education [7]. In order to act as a subject of the pedagogical activity, the professor must master, on the one hand, pedagogical attitudes aimed at developing the personality of the student, and on the other hand, he must be able to design a pedagogical activity based on the subject area [8] [9].

Thus, releasing a professor with the "Space monitoring" profile, the following problems of environmental education are solved:

- teaching students methods, means, techniques and tools for studying the environment, the ability to evaluate the data and to predict the consequences of events [10];
- developing students' understanding of the importance of an ecological worldview [11];
- providing a pedagogical basis for further education and upbringing other people in the spirit of ecological consciousness, thereby prolonging the knowledge gained for other generations that our students will teach [12].

#### IV. CONCLUSION

The ecological upbringing of personality is an essential part of his ideological training. Environmental education of students means the formation of their ecological consciousness — a conscious attitude to the natural environment in order to protect and rational use of natural resources [13]. The main goal of ecological upbringing is the formation of a personality characterized by a developed ecological conscience and culture [14].

The leading role in environmental education belongs to those educational subjects in which there is a great potential for the formation of a system of scientific knowledge in the field of the environment, rational nature management and environmental protection [15].

Environmental education is not a mechanical addition to general education. It should be an organic part of any level or system of education and training [16] [17]. Its content varies depending on social and economic conditions, the nature and state of environmental problems in different countries and regions.

There are two main directions of environmental education. Upbringing in the spirit of general ideas of nature conservation, careful attitude to it. And the acquisition of professional special knowledge about the general patterns of existence of natural and man-made ecosystems, the means, methods and tools for environmental monitoring, control of natural and man-made phenomena and forecast their consequences. Both of these areas are combined into a single professional activity of a teacher according to the "Space monitoring" profile in the preparation of bachelors in the specialty "Technical training (by industry)"

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