Formation of Ecological Knowledge of Schoolchildren Through Information and Communication Technologies

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Abstract. The article considers the process of formation of ecological knowledge of students through information and communication technologies, presents the main types of ICT and their features. Also, the features of the formation of ecological knowledge in children of primary school age are revealed. Psychological characteristics of children of this age, contributing to the assimilation of environmental knowledge and skills. The specifics of the variable programs for the course “The World Around” for elementary school are considered, which allowed us to conclude that it is necessary to systematically use information and communication technologies in the process of forming environmental knowledge in elementary school children. The paper summarizes typical eco-knowledge formed in children of primary school age; the stages and criteria for their formation are defined (motivation-target, creative-cognitive, evaluative-corrective and cognitive, emotional-value, practical-effective, respectively). The results of the study will allow for in-depth work in the direction of the formation of environmental knowledge of schoolchildren. A set of activities using ICT, aimed at the formation of ecological ideas among schoolchildren, can be applied by teachers when working in the field of environmental education.

1 Introduction

The interaction of nature with man at the present stage has acquired a global environmental problem. The reason for this is the low level of ecological consciousness of people, their lack of competence in matters of interaction with nature. In this regard, environmental education and education is one of the urgent problems of our time. At school age, the process of becoming a person’s worldview continues to develop. Ecological knowledge is the basis for the ecological outlook in general.

2 Research methodology

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At present, the search for effective methods and technologies for the formation of ecological knowledge of schoolchildren is being carried out. In this regard, the use of information and communication technologies (ICT) in education is becoming more and more relevant, since multimedia tools make it possible to develop the logical thinking of children in an accessible game form and strengthen the learning process. According to the Federal State Educational Standard, the use of innovative technologies increases the motivation of children to acquire new knowledge, accelerates the process of mastering knowledge and improves the quality of education.

The use of modern information and communication technologies is an effective means of enriching the intellectual sphere, stimulating interest in learning, developing creative abilities, and shaping the personality of younger students. Most authors recognize ICT as an effective means of enhancing learning. A number of researchers (L.A. Gabdulislamova, Yu.M. Gorvits, T.N. Grinyavichene, T.F. Gabay, E.V. Zvorygina and others) note in their works that the use of information and communication technologies in modern school education is one of the most important factors in improving the efficiency of the learning process.

As for environmental education and the formation of environmental knowledge, we can say that the beginning of this process occurs in preschool, and at an in-depth scientific level it continues in elementary school, at primary school age. This issue is dealt with by such scientists-teachers as A.N. Zakhlebny, L.P. Molodova, V.S. Mukhina, L.P. Saleeva-Simonova, I.T. Suravegina and others. In the studies of these authors, psychological and pedagogical problems of the development of a younger schoolchild, the specifics of environmental education in general, and age-related nuances in particular, are presented. In the field of formation of environmental knowledge, the main attention is paid not only to its content, but also to the technologies used.

3 Results and Discussions

Today, the issue related to the environmental problem, in particular in the interaction of man and nature, its impact on the environment, is very important. Under these conditions, the moral education of a person as an integral part plays an important role in environmental education. Ecological education of students today has the status of one of the most important public and educational tasks.

So what is “ecology”?

Ecology is the study of the relationship between animals and plants. In addition, we should mention the connectedness of groups among themselves, as well as the surrounding world. Ecology has become a broader subject, it now includes new skills and knowledge. At the moment, this is a science that is related to all areas of human life, whose comprehension needs continuous environmental education.

Environmental education is a learning process, upbringing, personal development, creation of the required knowledge and skills, value orientations that will create responsibility in relation to nature and health [1].

Environmental education is becoming more and more relevant, the same applies to the knowledge and culture of the environmental category. The duration and quality of human life is influenced by the number of environmentally literate people.

Within the framework of environmental education, an ecological culture of the highest level is created between all types of human activity that have a connection with the knowledge, growth and change of the environment around us. Environmental education is aimed at ensuring that the child learns to improve knowledge regarding the laws of nature, to understand the essence of the relationship between organisms and the environment, to create the ability to control their own mental and physical state.
According to L.P. Simonova, A.N. Zakhlebny, I.D. Zvereva, I.T. Suravegina, as well as a number of other specialists, ecological education is necessary in order to ensure the formation of ecological social and personal culture. The process of creating and becoming an ecological culture, which establishes an attitude towards nature, is complex. It is influenced by the characteristics of the age and capabilities of children. Primary school can be mentioned as the first age stage of education. A specific goal of education of an ecological category in younger schoolchildren can be defined as follows: the formation of a scientific-cognitive, emotional, moral attitude towards ecology, health. The basis of this process is the correct knowledge of the human environment.

Such a description is based on a holistic perception of the world, innate curiosity, susceptibility to emotions, the desire to study the methods of the natural and social environment, to learn how to help representatives of nature.

Among the features of environmental education, it should be noted the unity of sensory and rational knowledge of the natural and social human environment as important points in the formation of environmental culture [2].

Today, Russian environmental education is to be implemented as an environmental component of the main subjects, as well as a direction for the development of morality and spirituality. Ecological culture is created as an element of the content of the education section in primary school within the framework of the Federal State Educational Standard [3]. Therefore, education and development in this area become very important. For environmental education, it is important to understand what it is.

According to T.S. Ivanova, environmental education is a teaching, educational and personal process that is continuous. It has an impact on the creation of a complex of skills and knowledge, values, aesthetic and moral relations. This knowledge and skills are aimed at ensuring that the individual is responsible for the state of nature. In addition, continuous improvement of the parameters of this environment is necessary. The subject of the world around is designed to create knowledge of the ecological category in children, which are aimed at ensuring natural safety.

According to L.P. Simonova, as she points out in the article “Ethical conversations on ecology with younger schoolchildren”, environmental education should be mentioned [4]:

Scientific and educational element. Helps to improve the interest of children at primary school age in environmental problems. This leads to an understanding of the scientific picture of the world. Its representation is material that describes the characteristics of phenomena and objects, their relationships. For children at primary school age, knowledge about nature is interesting, which is important from the point of view of developing an attitude towards their own natural and social environment.

value element. Designed to show children the many sides of objects to be explored. This is the main point in education, in particular, in environmental education. In order to preserve life on Earth, human health, a good ecology is required. It is important to improve the personality within the development of civilization. It also requires the formation of a new value system:

a) life is the highest value, regardless of its manifestations;
b) natural values are universal;
c) a person enters a complex system that is subject to ecological study;
d) there is a responsibility for improving the biosphere and human society.

Normative element. Here we are talking about the rules of human behavior, as well as its activities in nature and society. The general culture of human behavior in terms of relationships with other people, their own health is following moral standards. Ecological culture is formed in childhood. Therefore, close attention should be paid to this issue.

Practical-activity element. This is the final result of relationships that are to be formed, the features of feelings and consciousness that are in the development stage. At the same
time, the relationship between man and nature is developing. The practical activity of younger students differs in its parameters, because children do not know what and how to do, they need to be taught.

Let us reveal the content of the concept of “environmental knowledge”.

Under the ecological knowledge of A.P. Pakhomov understands “knowledge about the relationship of plants and animals with their environment; about man as a part of nature; on the use of natural resources, environmental pollution, etc.” [5, p.46].

Environmental knowledge includes knowledge related to:
- natural objects and phenomena;
- natural relationships;
- the relationship between nature and man.

Knowledge regarding certain natural objects and phenomena is very important in terms of creating the right attitude of primary school children to the environment.

A correct assessment of the role of natural phenomena allows us to use them correctly and ensure their safety. In order to create the appropriate knowledge, children must regularly carry out activities of a cognitive nature, which is aimed at solving the problems of the ecological category.

An analysis of the standard (educational area - Ecology) shows that younger students receive environmental knowledge along four content lines:
- biosphere – global ecosystem;
- elementary ecosystems;
- man and mankind in the ecosystems of the Earth;
- methods for studying ecological interactions. [6, c.9]

According to I.A. Kairov, environmental knowledge is the result of pedagogical activity necessary in order to understand the laws and principles of activities aimed at ensuring the safety of nature [7, p. 83]. In the works of E.V. Girusova, S.D. Deryabo, O.V. Yakovenko and others can see the definition of ecological knowledge. This is knowledge relating to natural objects and phenomena, their characteristics, the entire system of knowledge relating to the surrounding world [8]. According to I.D. Zverev, ecological knowledge is the understanding of the relationship between nature and man, the animal world and its environment [9, p.49]. According to T.I. Tarasov, it should be said that there are two blocks in the knowledge system of the ecological category [10, p. 17].

At the moment, among the conditions for creating knowledge of the ecological category, the following should be mentioned:
- formation of motivation in order to create knowledge of the ecological category among young schoolchildren in the framework of cognitive activity. Motivation should include a need of a communicative-cognitive nature, which appears in accordance with the general need for achievement. It is one of the elements of the organization of knowledge, as well as a parameter of the subject of this activity;
- creation of knowledge of the ecological category in children in the framework of the implementation of activities of a cognitive nature. At the heart of this condition is the activation of internal resources of children. They should be as responsible as possible to the activities in which the information of the ecological category is used, the conscious receipt and formation of new knowledge of the ecological category in accordance with it. At the heart of the mentioned condition is the joint creativity of the student and the teacher;
- improving the knowledge of the ecological category that younger students have, which can be achieved in the framework of research on the ecological situation in a certain area. The implementation of this condition should be visual. The improvement of such knowledge leads to the fact that the independent activity of cognition is improved, aimed at studying the ecological situation in a certain area, region, city;
- application of ecological creativity in the relevant lessons. This activity is facilitated by the knowledge that has already been obtained. In accordance with them, new ones appear.

Creativity is aimed at forming and consolidating knowledge of the ecological category. Knowledge of the creative category is used both in the classroom and when doing homework. As part of the task of the creative category, children must show interest, which makes it possible to develop memory, attention, thinking, which will lead to great success in the emergence of knowledge of the ecological category later; creation of knowledge of the ecological category on an interdisciplinary basis. The reason for this is the acquisition of knowledge in the lessons of the surrounding world, the fixation of this knowledge in other lessons. This leads to the qualitative formation of environmental knowledge; the coherence of the content of work outside the classroom and in the lessons of the world around. This leads to the fact that the material covered is comprehended better. The formation of environmental knowledge, as well as their consolidation in the classroom, after which the same work is carried out at home. Knowledge concerning natural unity, connections between natural phenomena and objects makes it possible for students to understand that there is a need to maintain these connections. The Federal State Educational Standard of the IEO and the Model Program of the discipline establish the amount of eco-knowledge that a student must have after completing the course “The World Around”.

In this regard, the targeted formation of environmental knowledge among students becomes important, which leads to an active search for the most effective technologies and means.

Among the means of teaching environmental knowledge, the following can be mentioned:

1. Textbooks play an important role in solving the environmental problems facing the school. Compared to other teaching aids, the textbook has a more complex structure. The book also presents non-textual material, that is, maps, drawings, diagrams, and so on. All elements of the content of the textbook are interconnected. Today, teaching aids include information regarding certain natural objects and phenomena, the relationships between them, the impact of nature and people on each other, the norms and rules of external behavior, which helps in the formation of environmental knowledge of younger students.

2. Objects of the natural category. This is one of the most necessary means for mastering ecological knowledge. There are excursion and collection natural objects. They are required in order to create direct ideas about the objects and phenomena that are to be studied, as well as about their characteristics, relationships, connections. Acquaintance of younger schoolchildren with objects is carried out within the framework of sightseeing tours, as well as in the process of independent practical work, observation. The teacher talks about the objects to the students, points out their distinctive characteristics. Work in the second case is performed in accordance with the task of the teacher.

3. Instruments are used to show phenomena in the framework of the explanation of new material, as well as the performance of practical category work, various experiments.

4. Maps, pictures, tables and other manuals that are printed. Maps are widely used for the lessons of the world around. They are necessary in order to form spatial representations and concepts of how objects of nature are placed, features of natural phenomena. Pictures are suitable for introducing children to new material.

5. Tables are suitable for any stage of learning and any stage of mastering the material.

In addition to a variety of tools that contribute to the effective formation of environmental knowledge of younger students, there are modern technologies of a different nature:

1. Technologies for the formation of critical thinking.
2. Gaming technologies.
3. Technologies of problematic (developmental) learning.

4. Health-saving technologies, etc.

Among them, ICT (information and communication; information and communication; information; media; computer technologies) find their place. According to our survey of teachers, these technologies are a priority in the context of educational activities, since informatization and computerization of various spheres of life are now of great importance.

The use of information and communication technologies in a modern school can be found in almost every lesson, and especially the surrounding world, where, in turn, the development of environmental awareness, the formation of environmental knowledge of younger students.

We can say that ecological knowledge includes information relating to natural objects, the relationship between them, nature. Ecological knowledge is based on a whole system of knowledge that demonstrates nature as an interrelated whole (system approach).

Since the informatization of society and the educational system is now gaining momentum, which accordingly affects certain branches of education, the development and formation of environmental education and thinking in general, from our point of view, it is necessary to initially define its key concepts:

1. Information activity is a set of processes and actions carried out by the information community, using information resources and infrastructure in order to produce products and services in the educational environment.

2. Information infrastructure is an information channel and storage, information technology, legal, financial and economic base, under which information activities are carried out in the educational environment;

3. The information community refers to numerous subjects (organization and individual) in the field of education, which act as information generators, intermediaries and consumers of educational information resources.

4. Information resources mean documented data and knowledge in the educational environment, the circulation of which occurs through information channels that are accumulated in a library, archive, fund, database, etc. in a condition that can be used;

5. Informatization of the educational process is considered today as nothing more than a prerequisite for the creation of intellectual bases in the coming information society. Informatization in the educational environment is carried out with the aim of carrying out global rationalizations of the intellectual environment, introducing new information technologies, radically increasing the efficiency and quality in training personnel who will have new thinking, forming a new information culture, making education individual. For all the time that personal informatics has existed, many educational technologies have been developed, while the Internet has been updated in the educational process. For example, in the European society, more than 40% of people who use the Internet space do it for the purpose of getting an education - they receive training and educational materials, in the case of distance education, when it is necessary to use virtual reality tools.

Today, the world community is faced with a trend in which there is a global informatization in all spheres of society. Information technology development and its pace affect both the economic side of life and the quality of life in general, national security, in addition, affect the role of the country in the global space.

All developed countries and many developing countries are distinguished by intensive informatization processes in education. There is a development of ways aimed at improving results in general education, a great economic potential is being laid for the development and implementation of the latest technologies in the field of informatization [11].

In the global space, there is a trend associated with the widespread use of distance learning in the educational environment, which is the most important component in open education, which is being formed as a system.
In Russia, a unified information and telecommunication system (UITS) was created in order to implement the concept of advanced education, this idea was proposed by Academician A.D. Ursul, and she plays an important role in the development of modern educational trends.

The main essence of such an idea is to ensure the outstripping nature of the development of the educational process, despite other factors in the socio-economic and cultural aspect in social development.

As academician K.K. Colin [12], thanks to a system that is ahead of the educational process, a new type of consciousness is being formed in a person - noospheric, thanks to which a person will be able to realize his role in relation to nature, be responsible for today and for the future, including responding to a new information culture.

The personal responsibility of the child becomes higher, thanks to the autonomous activity that he performs. If decisions are made by him independently, after which positive results are obtained, this leads to positive emotions. This is how self-confidence is born. Children want to keep working, complicating tasks. Thanks to the computer, which plays the role of an electronic board, it is possible to increase the efficiency of the process and to test student knowledge.

The use of audio and video tools makes the lesson visual, increases interest in the learning process.

Very important for development and learning is video as an information tool. Most often, this material is used in the lessons of the world around. Thanks to video materials, the child acquires new knowledge, demonstrates an increasing desire to receive them even more, to find new sources for this. Children are beginning to use books, computers, educational programs and the Internet.

In practice, general education schools use information technology and the Internet - a space with great limitations, moreover, they practically have no connection in the pedagogical process. At the moment, this is all limited to computer science classes. Whereas in the case of distance education for schoolchildren, this aspect has not been fully developed and is just beginning to emerge. Russian-language educational resources are being developed at a very slow pace. For the wide dissemination of informatized technologies, the Russian general education school is constantly faced with an outdated and weak material base when informatizing the educational process; in addition, there is no Russian-language educational information on the Internet, which is being introduced at the level of the educational process for traditional schools, teachers are not ready to use information technology. If the Internet is used during the educational process, then it is necessary to create new electronic educational materials, rebuild the content and form of organization of the educational process, and retraining of the teaching staff is necessary. The emergence of information technologies and the Internet in schools should be timed with the emergence of technical means to solve the main problems, forming new socio-economic conditions in public life.

At this time, most of the higher educational institutions of the Russian Federation have access to computer networks. Although it is worth considering the very low level of informatization in educational and scientific spaces. Therefore, the main task that is proposed for solution in this area is to create educational programs and electronic libraries, develop distance learning, modernize and develop the appropriate network infrastructure and increase the bandwidth of the channel used. It is very important for higher education institutions to have a high-speed connection, which will have a bandwidth of 256 Kbps - 2 Mbps. Only under such conditions, Russian universities will be considered as important sources of information and telecommunications services that will provide secondary general and vocational education.
Education with the problem of informatization must be considered as the fundamental and most important global problem of our century. Having formed a unified information educational environment, it is important to note the increase in the requirements that apply to the level of quality of work and the pedagogical qualification level, including scientific and managerial personnel, in general and vocational education. A change for the better in this area occurs due to the state and level at the material, technical, scientific, methodological and informational level of equipping the educational environment, and in the preparation of the teaching staff.

Thus, information and communication technologies have rightfully occupied their niche in the system of modern digital education. In general, the digitalization of education could not but affect the elementary school, and there are several reasons for this: as mentioned above, younger students best learn information through games and game situations, therefore, the introduction of ICT will make it possible to implement educational and educational tasks.

The use of ICT in the environmental education of children of primary school age during school hours and after school hours can be varied. Children’s environmental education, which is also implemented within the framework of the “World Around the World” subject, is a school area in which the use of information and telecommunication technologies can lead to an increase in the activity of all types of activities in and out of the classroom, both teaching and educational.

To work on the formation of environmental knowledge of younger students, it is advisable to use specialized or adapted educational computer programs and various sites on the Internet:

- Sound materials are recordings of the voices of birds, mammals, the noise of the forest, sea, rain, wind, etc.
- On-screen materials - a series of individual frames or slides devoted to a particular topic. In terms of static, they resemble didactic pictures.
- Multimedia presentations are educational materials that help to tell children about the world around them.
- Multimedia ecological games can be included in the content of classes: travel games, riddle games, didactic games, quizzes, etc.
- “Virtual excursions or travels” provide an opportunity to visit inaccessible places, make a unique journey. For example: “Excursion to Africa”, “To the North Pole”, “Excursion to the library”. Children take such excursions with great pleasure.
- Use of an interactive whiteboard. Developing classes with its use can become much brighter and more dynamic. The use of an interactive whiteboard can be used when working on the learningapps.org sites, as well as on the uchi.ru, umnazia.ru sites.
- Use of an electronic character. Children in primary school age are very susceptible. And they are much more interested in situations where the dialogue on behalf of the hero is not conducted by the teacher, but by the hero of the situation himself.
- The use of ICT will make eco-classes emotionally colored and attractive. Children will become active rather than passive objects of pedagogical influence, they will show keen interest, interest and activity, which contributes to the good effectiveness of the lesson.
- The use of ICT in the development of eco-knowledge is not limited to activities with children and includes work with parents.

One of the criteria for the professional activity of a teacher, in accordance with the Federal State Educational Standard, is a high degree of activity and involvement of parents in the educational process and school life. Currently, many parents do not have enough time to attend various events held at the school, many parents do not read the materials on the
information boards. Therefore, in social networks, you can create a personal eco-page. This is very relevant at the present time.

You can also hold various eco-competitions, during which children together with their parents during a joint walk, or traveling to another city or country, will take pictures, videotape various landscapes, nature, vegetation, wildlife.

As part of the study of new material, it will be useful to demonstrate illustrations on computer monitors or special screens. Very important are simulations, modeling of processes in nature, which are subject to study.

Systems for monitoring environmental knowledge, including electronic ones, are absolutely indispensable in the process of inspections and control work. At the moment, there are a significant number of programs for the study of environmental issues. These programs can be educational, developing, they are suitable for use in elementary school.

As part of the practice in nature, you can use photography and video filming in order to capture the phenomena of nature, flora and fauna. Projects on environmental topics are the means to implement the education of environmental culture. To carry out such projects, photos, videos, programs are used to edit and demonstrate the footage. Communication-type technologies are also used, thanks to which the exchange of ideas and materials between educational institutions is carried out. Projects can be joint.

The results of the work can be summed up in the form of scientific environmental mini-conferences. Thanks to such work, younger students are actively involved in environmental education and upbringing. The Internet is also important for preparing for lessons, thanks to which information is searched and researched regarding environmental problems. A multimedia presentation is one of the most suitable and popular options for preparing and demonstrating educational material in primary school. This technique is convenient and efficient for demonstrating data through programs. It presents sound, image, dynamics. All this leads to simplicity in keeping children’s attention. Presentations are suitable for all stages of work aimed at environmental education.

The use of educational resources of the electronic category makes it possible to support environmental education, to realize existing goals. Examples of such systems should be pointed out - the encyclopedia “Krugosvet”, the manual “Nature. Human. Society”.

Thanks to the use of ICT, it is possible to increase the reasonableness, mobility of the classroom and extracurricular forms of eco-work. This is a very important moment for children of primary school age.

As a rule, the following tools are used:

- Funds aimed at the formation of basic training. These are textbooks in electronic format, systems designed to control knowledge, computer games for learning.
- Funds aimed at practical training. These are electronic workshops, simulators and designers.
- Auxiliary resources. These are libraries of electronic format, encyclopedias, specialized computer games, multimedia category training sessions, diagrams, diagrams and much more.
- Comprehensive tools. These are courses for learning that can be completed remotely.

ICT for the development of children of primary school age leads to the formation of a creative positive atmosphere. The use of visual images leads to the fact that the motivation for the learning process grows. The cognitive processes of the mental category also improve, learning becomes more intense within the framework of choosing an individual learning rate.

4 Conclusions
Having studied and analyzed the psychological and pedagogical literature on the research problem, we made the following conclusions:

Environmental education is a complex process of upbringing, personal development and training, which involves the creation of the required environmental knowledge and skills, value orientations that will create responsibility in relation to nature and health.

In the process of environmental education, a system of knowledge is formed that ensures a responsible attitude to the surrounding social and natural environment.

Ecological knowledge is the preservation in memory and reproduction of ecological concepts, rules and laws. It gives a person the following: the ability to reason correctly; the ability to feel, understand and appreciate the beauty of the surrounding world; capacity for goodness and morality; understand important truths.

A large place in the environmental education of junior schoolchildren is given to the formation of environmental knowledge, because a feature of the junior school is the formation of a new type of educational activity. Primary school is the most important stage in the intensive accumulation of knowledge about the world around us, the development of the multifaceted relationship of the primary school student to the natural and social environment, which contributes to the formation of personality, the formation of ecological culture. One of the main tasks of environmental education at the present stage is the formation of environmental knowledge in schoolchildren.

The use of technologies of the information and communication category within the framework of environmental education leads to the fact that the ability of students to navigate in the data flows of the surrounding world is in the process of improvement. The same applies to the study of practical methods of working with data, the development of skills through which data is exchanged through technical means. It is required that the class be provided with everything necessary.

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