



Humanitarization of Natural Science Education of Elementary School Children: Challenges and Opportunities

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Abstract

On the one hand, the state of the problem of natural science education of elementary school children (NCE) includes a trend towards humanitarization, and on the other hand, a complex of efforts is required to implement it. The purpose of this paper is to develop a theoretical underpinning for humanitarization of NCE of elementary school children as a complex and open education system, and the rationale for its methodological system and results. The key methods were the methods of diagnostics and evaluation of the experimental pedagogical work. The paper provides the background for the requirements to humanitarization of NCE of elementary school children, namely the need to develop a variable subject and character formation content and to actualize the subjective reflective and creative position in its absorption. The paper demonstrates the methodological system of natural science education of elementary school children based on the idea of humanitarization of the education system and its procedures, its structure, the conditions for its implementation, including the cluster approach to the organization of the education process. The key major purpose of education is to comprehensively develop personal, metasubject and subject-specific results of absorption of the contents of humanitarized natural science education, which are reflected in the personal qualities of the elementary school children.

Keywords: Natural Science Education Of Elementary School Children, The Humanitarization Principle, Humanitarization Of Natural Science Education Of Elementary School Children, Personal Identity

1 Introduction

1.1 The rationale of the problem

In this study, the humanitarization-based natural science education (NCE) of elementary school children is a complex system that includes a number of subsystems, namely:

- a) Teaching the basics of natural science within The World Around Us course, where the main performance indicator is the level of literacy in the natural science field among elementary school children;
- b) Moral and environmental nurturing; and
- c) Moral and environmental development, where the success criterion is the integrative personal result (moral and environmental identity of the student's personality) (Nesgovorova, Savelyev, Tebenkova 2018).

This approach implies a greater significance of developing students' values system within the natural science education, starting with The World Around Us course.

However, the results of a survey of elementary school teachers and teachers of natural science disciplines regarding the functional significance of their disciplines indicated that teachers underestimate the humanitarian functions of the courses they teach, including the character formation function. In accordance with their understanding of the functions, the teachers mostly use the methods of developing knowledge and skills, which does not allow to fully actualize the humanitarian potential of the contemporary paradigm of natural science. Students' personal achievements in absorbing the content of The World Around Us course indicated such deficiencies as the lack of understanding of universal human values and ways to manifest them in relation to nature in 37% of the students.

This suggests a contradiction between the changes in paradigm of contemporary natural science education in the humanitarian aspect and the tradition of object- and knowledge-based structure of natural science education in the elementary school, which makes it impossible to achieve the objective of harmonious development of students.

In the current Educational Standard, the objective of harmonious development of students is defined as their achievement of personal, subject-specific and metasubject

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educational outcomes. Meanwhile, humanitarization makes it possible to combine all three groups of outcomes in a unity. At the same time, the authors have not found any specialized publications that would suggest new approaches to humanitarization of natural science education in the primary school in the context of actualization of the 2009 Educational Standard.

Methodological support of authorial curricula of The World Around Us course suggests a number of humanitarization options, but there is still no methodological system that would allow reconciling the contents of natural studies and humanities, and the ways of perceiving nature in the classroom and extracurricular activities.

The authors' analysis revealed a lack of effectiveness of authorial methodologies in achieving all the groups of educational outcomes. For example, 60% of 4th-grade students have a low level of skills of explaining phenomena, describing observations and experiments that are required for TIMSS tests.

Another contradiction emerged between the objective of natural science education in line with the requirements of the Standard and the lack of a concept or methodological system for humanitarization-based education.

The contemporary elementary school child lives in the two worlds: the empirical world of popular culture and nature, and the theoretical world of science and education based on abstractions, concepts, and logical frameworks; this is why the key objective of humanitarization of education is to harmonize the relationships between those two worlds. It is noteworthy that all the The World Around Us authorial curricula are aimed at developing a comprehensive worldview. HOWEVER, the ways of perceiving nature are limited to abstractions and artificial models that make up the basis of theoretical thinking skills, often to the prejudice of the empirical thinking.

Another contradiction emerges between the understanding of humanitarization as a personality development process that requires a comprehensive perception of nature, and the fragmented humanitarian component within the authorial curricula.

The study of deficiencies in the outcomes of natural science education of school children revealed that they are associated with the fact that primary school teachers are not yet ready to implement the humanitarization principle in practice. About 88% of teachers understand the need for humanitarization, but lack knowledge on the contemporary child psychology and have certain issues with the methodological readiness.

The revealed contradictions determined the rationale of the study and allowed to define its

1.2 Problem, purpose and goals

The purpose of the study is to develop a theoretical and methodological background to humanitarization of the natural science education of elementary school children, to demonstrate its methodological system and a number of its results.

The experience of humanitarization of natural science school disciplines was explored by I. S. Aleksashina, V. I. Danilchuk, V. R. Ilchenko, S. A. Komissarova,

N. S. Purysheva, N. A. Khomutsova, N. V. Sharonova, O. A. Yavoruk.

Trends towards humanization in the society and science humanitarization in the late 20th century determined the need for humanitarization of natural science education (NCE) in the elementary school, which was understood as the integration of natural, cultural and humanitarian aspects of its content. A variety of methods for humanitarization of natural science education within The World Around Us course can be found in the teaching materials by A. A. Pleshakov, N. F. Vinogradova, G. G. Ivchenkova, I. V. Potapov. In Russia, the idea of the integration was implemented in the authorial curricula of N. F. Vinogradova's The World Around Us course, which was included in the Federal State Educational Standard of General Elementary Education in the early 1990s.

In the new generation Standard (2009), the concept of humanitarization of NCEs is associated with personal development in the course of learning the discipline's content by students through participating in a system of various activities. This is the essence of the learner-centered approach to NCE.

2 Materials and methods

The methodological system of humanitarization of the natural science education of elementary school children was developing 11 years. It involved about 300 education system specialists and more than 800 school children and students.

The procedural aspect of the **methodological system** is represented by the technique of developing personal identity in elementary school children. It includes three stages: introductory and value-developing; nature-focused and cognitive- and activity-related; and human-centered and regulatory- and activity-related stage.

At the initial stage in the 1st and 2nd grades, education is aimed at developing the value component of the personal identity, and is actualized through value developing methods, including methods of *contemplation*, *reflection on wisdom*, the methods of cognitive development (*brainstorming*), identification methods (*being in silence*, *reflection games*).

At the next stage (the 3rd grade), education is focused on developing knowledge and skills that constitute the cognitive component of identity.

The third stage of education (the 4th grade) is aimed at developing the regulatory- and activity-related component of identity. Such methods are applied as working in small groups on risk analysis, construction of rules for safe behavior in nature.

The assessment methods of the experiment (the diagnostics mechanism of the study) includes a combination of objective evaluation methods and procedures that enable to judge the scientific validity of the results, and the subjective ones that allow to capture the inner nature of pedagogical phenomena.

To assess the quality of NCE of elementary school children as a process, the method of humanitarian examination in education was chosen (S. L. Bratchenko, I. E. Kuzmina, A. N. Tubelsky, V. A. Yasvin) and the method of its application (N. Yu. Sergeyeva). The advantage of humanitarian examination is obtaining independent

opinions from a variety of target groups (parents, teachers, school principals, associate researchers, methodologists). For the study, an independent expert group of 9 people was created, which included employees of the Kurgan State University, the Institute for the Development of Education and Social Technologies (IDEST), teachers and directors of general education schools and institutions for supplementary education for children, and the methodologists of the educational administration of Shumikha town.

The work of the group was supported by methodological tools that included specially developed questionnaires and expert evaluation forms, the data on the indicators of the humanitarian quality of natural science education (NCE) of elementary school children. During the experiment, the experts attended 4–24 lessons and after-school classes. They studied the materials of express tests, children's creative, design and research projects, interviewed teachers and parents. The expert group judgment formed the basis for the conclusion about the quality of NCE of elementary school children as a process that lays the foundation for personal development of children.

During the examination, the following additional sources for documenting significant aspects of NCE humanitarization of elementary school children were used: quantitative methods, analysis of videotapes of classes, children's works (review essays, drawings, projects).

Jointly with the expert group, a scoring method was developed for the indicators of humanitarization quality of the education under study, that involves assessment of the level, frequency and stability of manifestation of each indicator on a nine-point scale (9 points being the highest level of manifestation) (17).

3 Findings from the study

Figures 1 and 2 shows the development of personal identity components.

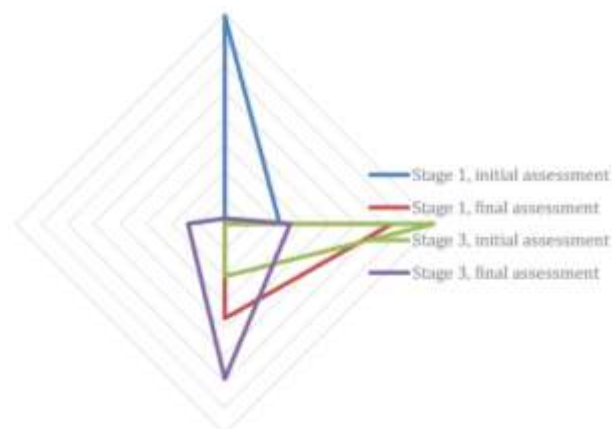


Figure 1: The level of personal identity of learners from the experimental groups at the 1st and 3rd stages of its development, General Education Secondary School No. 3

Note: 1 — zero level, 2 — low level, 3 — medium level, 4 — advanced level

Findings from this study validate the hypothesis of a gradual, step-by-step development of personal identity of

elementary school children of Shumikha GESS No. 3. At the third stage, the level of personal identity indicators is mostly medium or advanced.

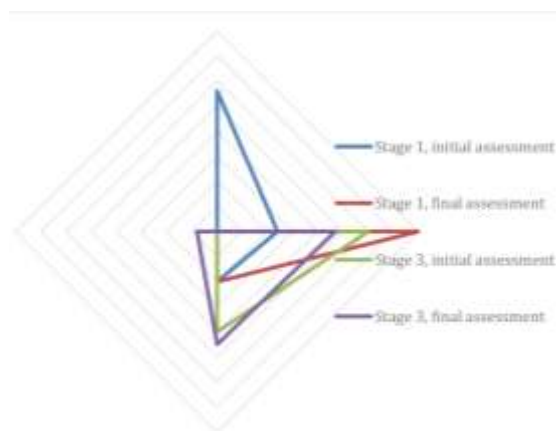


Figure 2: The level of personal identity of learners at the 1st and 3rd stages of its development (control group)

Note: 1 — zero level, 2 — low level, 3 — medium level, 4 — advanced level

As for the control group of school children, the level of the consolidated personal identity indicator in the final assessment is distributed between the low, medium and advanced levels, predominantly the low and medium levels.

The dynamics of development of individual components of personal identity, the experiment results and their mathematical assessment indicate a statistically significant growth in the level of the value-related indicator of personal identity among elementary school children of the Shumikha School No. 3, the presence of the advanced level at the final stage of the experiment (Figure 3).

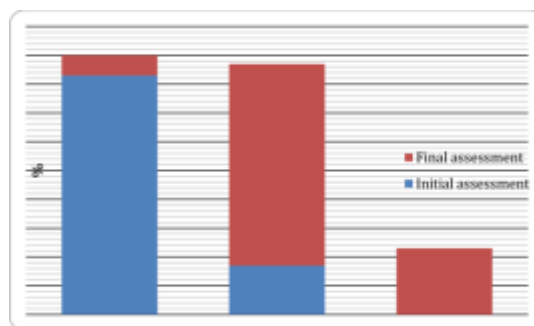


Figure 3: Development of the value component of personal identity in school children of Shumikha GESS No. 3 (76 people)

Note: 1 — low level, 2 — medium level, 3 — advanced level

A similar phenomenon was observed with the development of the cognitive component, however, with a lower cognitive component at the advanced level (Figure 4). As for the development of the regulatory- and activity-related component, a similar stable trend can be observed of positive effects of humanitarized natural science education of elementary school children, which is manifested in a significant decrease in the number of school children with a

low level, an increase in the number of school children with a medium level and the appearance of school children with an advanced level of personal identity development by the components (Figure 5).

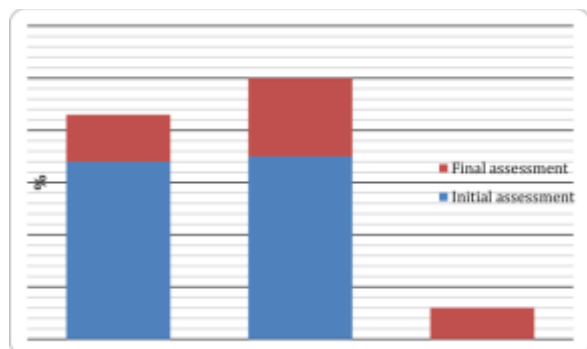


Figure 4: Development of the cognitive component of personal identity in school children of Shumikha GESS No. 3 (76 people)
Note: 1 — low level, 2 — medium level, 3 — advanced level

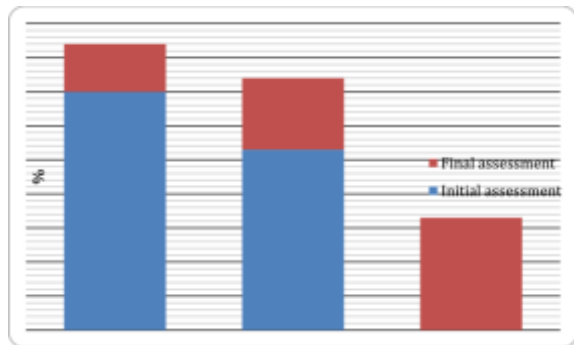


Figure 5: Development of the regulatory- and activity-related component of personal identity in school children of Shumikha GESS No. 3 (76 people)
Note: 1 — low level, 2 — medium level, 3 — advanced level

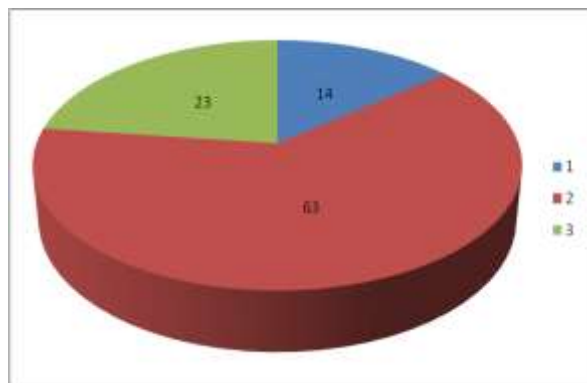


Figure 6.: Development of the personal identity of school children in the experimental classes of Shumikha GESS No. 3.
Note: 1 — low level, 2 — medium level, 3 — advanced level

The final assessment of the development of an integrated educational outcome in the form of school children personal identity showed that it is still too early to claim that the technique was absolutely successful. There are subtle aspects that are not always taken into account (Figure 6). Overall:

- The development results of the value component show that about 70% of the children achieved a medium (sufficient) level, another 12% achieved the advanced level;
- A similar trend is observed about the development of the cognitive component;
- The regulatory- and activity-related component is developed in 53% of the learners at the medium level and in 33% at the advanced level.

This means that 86% of school children achieved the integrated educational result at the medium and advanced levels. The quantitative data from the study suggest that the effects of the methodological system on the educational outcomes tend to be positive. In General Education School of Kamenskoye village and Shumikha General Education Secondary School No. 3, where the new content was systematically introduced into the curricular, extracurricular and character formation activities, educational outcomes of the students of the 4th grade were significantly higher than that in the control groups on Shumikha GESS No. 4.

Subject-specific and metasubject educational outcomes (cognitive-conceptual component of identity) in Shumikha GESS No. 3 was somewhat higher than that found in the Kamenskoye General Education School. This might be due to a higher competence of teachers of the urban school than that of the rural school, and general school ability of urban students. However, the indicators of the value-related and semantic component are much higher among learners from the rural remote area than that among the urban school children. It is assumed that the good performance of Kamenskoye School children is due to the effective work of the family club with a moral and environmental orientation that also involves parents.

The sensitive points of moral and environmental identification in the elementary school age indicate the emergence of predictive new formations of personality in a number of learners who have reached an advanced level for a given indicator of understanding the ethical foundations of interaction with the world and the need for regular practice of the obtained values in real life; for the indicator "Stable manifestation of moral behavior models" a stable interest was observed in interaction and experiencing nature, active love of nature (in the form of caring). The humanitarian examination method was used to assess the quality of the created conditions. Figure 7 presents the aggregate expert evaluation results (average value in points) of the humanitarian quality of NCE of elementary school children. The experts who took part in the examination gave a high rating to all the criteria of the *humanitized* education process.

Average value by indicator								
1	2	3	4	5	6	7	8	9
The priority of the human element over the subject-specific natural science focus of classes						8.7		
Value-conceptual level of absorption of the content						8.8		
Dialogue interaction						8.7		
Personal significance of the lessons						8.7		
Children's cognitive interest in the studies						8.5		
Psychophysiological comfort of the lessons						8.9		
Engagement of all the children in the lesson						8.3		
Interest and engagement of parents (caregivers) in education						7.8		
Interest in self-understanding, understanding of other people and nature						8.2		
Low level			Medium level			High level		

Figure 7: The expert evaluation of the quality of NCE of elementary school children (average values by indicators, points)

4 Results and Discussion

The contemporary education paradigm implies integration into the European educational space and should include the need of development of quality education in Russia (10). The public attention to the development of the creative potential in younger generations in Russia with a focus on the relevant personal qualities determined the need for humanitarization of education at all its stages. At the regulatory level, this is enshrined in the Law on Education, the Concept of Spiritual and Moral Education, the Education Development Program, in the educational standards (13).

However, the concepts of humanization and humanitarization are often confused and interchanged. A comparative analysis the concepts of humanization and humanitarization of education, according to T. M. Elkanova and other researchers, suggests that "humanization of education" means creating a humane education system in a society in line with the humanitarian values and ideals, while "humanitarization of education" means making the teaching able to indicate its place and role in the social and cultural context of the era (1, 9). The need for humanization of education was intensified by the requirement of replacing the technocratic approach to nature, society, and people. The existing trend towards the determinant of the differentiation of ways of understanding the world should give way to their integration and systemic approach to understanding the world.

A solution to the current situation can be humanization of education, primarily in natural science. According to Irena Kulisha, the meaning of humanitarization is to align the contents, process and form of education with the human nature, human soul and spirit, to activate the integrity of the human inner world, to develop the personality with a high integrity. She designed a unified humanistic profile of a specialist based on the humanistic personal qualities, such as freedom, thinking skills, mentality, culture, creative spirit, values and purpose, responsibility (4).

The importance of humanitarization of pedagogical education is explored by Galyna Tarasenko. She believes that humanitarization should create the conditions for self-realization and self-determination of the future teacher in the

context of the modern culture against the background of each student's unlocking their creative potential, the formation of global (noospheric) thinking skills. She observed that an important feature of humanitarization is integrity: it develops of a holistic worldview and the place of humans in it and determines the focus of education on the priority of the creative identity (Tarasenko 2018).

At the methodological level, the humanitarization principle is reflected in the provisions of the humanitarian education paradigm, learner-centered and system- and activity-based approaches to higher education. However, as observed by O. V. STUKALOVA, V. V. KUDRYAVTSEVA, E. A. GANAEVA, M. Y. FADEYEVA, O. M. OSIYANOVA, and V. V. NATOCHY, the researchers managed to substantiate the principles of humanitarization of the content of higher education, which are aimed at the synergy of personal, creative, and professional development of the future specialist. Process optimization conditions, its techniques and pedagogical conditions for achieving the strategic goals of educating the "man of culture" at the university were determined (5). Humanitarization can also be seen as "a way to connect a young person to the spiritual values of the civilized world, since its improvement in the broad sense of the word, does not come down to a narrow professionalization" (Kravets, 1996), humanitarization is necessary for the logic of the learning process (Gaisin et al., 10).

The contemporary elementary school child lives in the two worlds: the empirical world of popular culture and nature, and the theoretical world of science and education based on abstractions, concepts, and logical frameworks. Therefore, the key goal of humanitarization of education is to balance those two worlds, to develop a holistic worldview, to overcome the identity crisis of the individual. To cite Peggy J. Jenkins, these three domains of knowledge can be brought together to solve the global objective of accelerating the human consciousness growth (6).

The natural science education of elementary school children is viewed in this paper as a complex system of absorption the nature science content during the cognitive and identification activities of the learners, which is aimed at

the development of both natural scientific literacy and identity (16).

A study of research publications and methodological works suggests that the problem of natural science education of elementary school children is a subject of investigation for the following disciplines: physics, biology, chemistry. However, E. V. Bondarevskaya, V. V. Serikov, I. S. Yakimanskaya suggest that personal development of the student implies a stronger pedagogical attention to development of such functions of the students as conceptual-learning, value-, worldview-related, and the subjective functions through creating specific educational situations. The first international attempt of humanitarization of education should be attributed to Rudolf Steiner's twelve senses theory (2). The character formation of the person with new qualities (value systems, world perception, thinking skills), which must permeate the content and techniques of studying the natural studies component of The World Around Us course is mentioned in the methodological recommendations for the teacher. However, the analysis of existing curricula and methodological recommendations for The World Around Us course by A. A. Pleshakov, N. F. Vinogradova, and O. T. Poglazova showed that the objective of personal development of students is currently neglected.

In this paper, humanitarization of the natural science education of elementary school children is viewed as the quality of the educational process that involves creating an educational situation (of personal development, identification), in which the learner is required both to render the obtained knowledge and the correct sequence of steps when completing their assignments, and reflect on the meaning and values of understanding natural laws, which ensure successful achievement the unity of subject-specific, personal and metasubject educational outcomes (16).

To cite Peggy Joy Jenkins, children who develop a healthy balance of mind and spirit enter adulthood with higher self-esteem, better able to respond to life's challenges (7). They are better able to respond to life's challenges when given the tools to think and discover for themselves. She notes that the greatest gifts that a child can receive are an opened mind, a caring heart, and ignited creativity (7). We should agree with Seimbika U. Bichurina in that even for an elementary school child, working with love and finding pleasure in it is an essential prerequisite for the development of their creativity and talents (8). New foundations of humanitarization of the natural science education of elementary school children are associated with a synergetic paradigm in natural science. It sets a holistic approach to the world, human beings and human relations. An example may be the idea of seeing the researcher as a subject and participant in the phenomena they study. The synergetic approach is also appropriate in this area of the study from the perspective that, as Hermann Haken observes, a wide variety of phenomena can be described with general concepts such as stability and instability, order parameters... Such general principles can bridge the gap between natural and social sciences (3).

The development of the postnonclassical model of natural science education (NSE) — which is based on the

humanitarian nature of the contemporary natural science, which focuses on the quality of the subject of understanding nature and their subjective and creative activity — can change its content, as shown by N. Z. Aliyeva, V. A. Ignatova and others. The basic principles of the postnonclassical paradigm are nonlinear nature, constant self-development, subjectivity in the knowledge generation, and dialogue.

However, the structure of natural science education at school is still based on the requirements of classical science: 1) Linear nature (propedeutics in primary school and the 5th grade, then linear natural science subjects with the contents being structured according to the sections of classical natural science: according to its historical development); 2) Sustainability (for 300 years, the sections to study and the components of natural science, forms and methods of learning activities remain almost unchanged); 3) Objectivity (ready knowledge from textbooks is mostly taught, without taking into account the subjective component in content and methods). Without prejudice to the classical stage of scientific development and the classical methods of teaching natural science, in the context of the postnonclassical phase of science development, the theoretical and methodological principles of the past should not remain at the foundations of NCE in the elementary school.

The provisions on the importance of the value-related quality of the researcher (anthropic principle) as a driver of global changes form the foundation for the development of NCE based of philosophical and anthropological theories of human formation (F. I. Ilyin, V. N. Sagatovsky, A. I. Subetto), the thinking and worldview of which associate the scientific knowledge with value- and purpose-related structures. The movement toward the noosphere, including the current stage of sustainable development, requires that the new generations have not only knowledge and skills to support their own life, but also a different *value* system. V. N. Sagatovsky defined the axiological human type, the bearer of new values, as the creator focused on the extending the harmony in themselves and in the world.

The elementary school child appears in the values system as a knowledgeable, kind, responsible, creative individual, whose actions serve as criteria of their maturity. The scientifically grounded learner-centered approach in pedagogics nurtures such a personality. In this regard, the humanitarian aspect of education defined by N. V. Nalivaiko and V. A. Parshikov as "the level of actual self-determination of the personality in the culture", differs from its traditional understanding as a sum of cultural and humanitarian knowledge. What do the authors of the new concept offer to implement humanitarization? To supplement the educational content with information from environmental studies, folklore, history, local history, and literature without activating the subjective position of school children in the learning process. This approach determines the understanding of the educational outcomes of humanitarization of the natural science education of elementary school children through the category of identity.

Identity allows integrating the requirements of the Federal State Educational Standard for Basic General Education with subject-specific, personal and metasubject

outcomes of absorption of the natural-science content necessary for the continued NSE in the secondary school.

The problem of personal identity is a traditional philosophical problem, which, on the one hand, can be designated as a problem of identity of a person, and, on the other, as its persistence, i.e., we can express this in the formula "Me is me". Identity, therefore, is the identity of the social and individual in a human as an evolving result of recognition and confirmation by the other of the existential choice made by the human being.

For example, E. O. Trufanova established "a separation into two main trends in the approach to *Ego*. One of the lines goes back to Descartes and asserts that *Ego* is the original absolute givenness. ...However, more popular is currently another line, which implies a gradual construction and reconstruction of *Ego* in the course of the individual personal development of human beings — this is a constructivist approach" (18).

In the history of philosophy, both of these trends can be observed. For example, in R. Descartes' works, thinking of the individual which they identify with *Ego*, acquires the absolute autonomy of being. I. Kant's theory asserts that *Ego* is constructed through a priori forms of sensory experiences of space and time and a priori categories of reason. This provision formed the foundation of the constructivist approach to *Ego*. Later on, the development of the constructivist approach to *Ego* was influenced Z. Freud's view of the personality structure, in which he distinguished *Ego*, *Id* and *Superego*, which enabled him to introduce the unconscious into the *Ego* structure.

In the philosophy of the 20th century, the most anthropologically interesting ideas are those by J.-P. Sartre. He translated the issue of *Ego* from epistemology, where it was looked at in the classical philosophy, into anthropology, and developed the issue of *Ego* as a problem of self-deception, exploring such actions of consciousness intimacy as denial, irony, lies, love, masochism, indifference, desire, hatred, and sadism. Sartre affirms that the *Ego* needs the other: "I can know myself only through the mediation of the other, which means that I stand in relation to my "id," in the position of the *Other*" (15). The understanding of the process of constructivization of *Ego* was influenced by the philosophy of virtual reality that showed that a person can construct in their mind a variety of psychological realities that represent possible virtual worlds.

Publications mostly distinguish the cognitive *Ego*, the psychological *Ego* and the social *Ego*. It appears that the highest level in the *Ego* hierarchy is the person's spiritual *Ego*, which was understood by V. Frankl (20) as the desire for a purpose and creation of values. Therefore A.K. Abisheva's definition of *Ego* that goes back to V. Frankl's definition appears the most accurate: "If attachment to a particular value or hierarchy of values is the basis that organizes everything else both in the soul and in external manifestations, then they constitute the core we call the human *Ego*" (11).

Philosophy of the 20th century affirmed the idea of the plurality of *Ego* in the personality and concluded that between them, it is not the conciliation that prevails, which is necessary for the personal integrity, but a conflict that often

leads to its disintegration. This conclusion led to the elaboration of the problem of the crisis of *Ego* as the crisis of self-identity of the individual. It was the direction of E. Erickson's and V. Hösle's ideas. In the Hösle concept (21), the analysis appears to be valuable of the subjective causes of the crisis of individual identity, among which he emphasizes *Ego*'s loss of the belief in moral standards and values, fear of death, incorrect descriptive and normative images of selfness, disappointment in the other, etc.

In the contemporary constructivist approach, the central problem is the methods of constructing *Ego*. Based on numerous psychological studies, E. O. Trufanova (18) distinguishes a variety of methods depending on how *Ego* is constructed — as a theory or as a narrative. In the first case, discursive practices are distinguished (*Ego*'s sociocultural contexts expressed in the language), in the second case — expectations and hypotheses of the personality about itself; life stories, in which the personality both live and tell about themselves; ways of organizing episodes, actions and action reports where facts are blended with fantasies; possible *Ego* about the future of the individual, while the current *Ego* is termed the self-concept.

It is shown that due to the multiplicity of discourses the personality is engaged in and a variety of narrative descriptions of *Ego* by the personality itself, its self-identity becomes split. Self can be disintegrated into disconnected elements, and then some of them acquire a relative independence and are imposed to Self from outside; depending on the roles that the personality plays, Self can become a role; images of Self can contradict each other, causing negative existentials; situational self-identity can be accepted by the personality as its basic self-identity; the personality may be unable to integrate its life narratives into a single integrated system or a single life story. Under these conditions, the personality can assume the normative identity that is imposed socially or culturally or by other people's expectations, thereby losing the freedom of choice and authorship in the creation of its basic self and its sustainable self-identity (19).

Humanitarization in this study is viewed as an integral property of the system of natural science education of elementary school children, which determines the new quality of the learning process and a new level of unity of its outcomes. The study shows that humanitarization as a quality of natural science education is ensured through progressive situations of personal development and identification. In those situations, the learner is required to search for and reflect on the purpose, the value of understanding the natural laws. It is suggested that the criterion for achievement of the new quality of the learning process should be the level of the elementary school child's personal identity, which is understood here as a complex educational outcome that includes subject-specific, metasubject, personal results and is manifested in the integrative personal quality that reflects the reflexive and creative origin of knowledge in relation to nature and its understanding, to family, friends and themselves (17). The axiological approach made it possible to distinguish the values for identification by elementary school children and to align them with the corresponding activities. The core of our concept includes 4 basic ideas:

- 1) Natural science education is aimed at shaping in school children a worldview as an entirety that is developing towards the harmony that can be creatively supplemented by the human being;
- 2) The achievement of the unity of the educational outcomes is based on implementing the idea of humanitarization in the learning process;
- 3) Humanitarization of education is carried out through including a variability component in the content of The World Around Us course and extracurricular activities with the appropriate step-by-step methodological support;
- 4) Methodological support of teachers is carried out within clusters: temporary creative associations of educational process participants.

The ideas have their corresponding principles and regular connections. For example the implementation of the idea of "the need of shaping the worldview in school children as an entirety that is developing towards the harmony that can be creatively supplemented by the human being" displays a regular connection with "the objectives and content of natural science education of elementary school children with the requirement for personal development and the development of cross-functional educational activities". This connection is actualized through the principles of personal integrity, metasubjectivity of the content and activity methods. The methodological system of the humanitarized natural science education of elementary school children includes the following components: content and objectives, procedures, outcomes and management. The objectives component includes the following groups of objectives: cognitive (the development of a systemic thinking style in learners among the subject-specific and metasubject results), and affective (aimed at the development of moral and environmental identity as a complex personal outcome) (12). The content component of the methodological system integrates the invariability and variability components of The World Around Us course contents, that are implemented in the classroom and extracurricular activities.

The invariability core in the authorial curricula is based on a systemic approach to representing the natural world, i.e., revealing the structure, the basic connections of natural objects and phenomena. The invariant includes "Inanimate nature", "Wildlife" and "Human Being" modules. Selection of the variable content on the basis of the general set of approaches, including the dialectical, metasubject and phenomenological approaches, ensures the integration of the classroom and extracurricular activities. The dialectical approach allows to harmonize the development of empirical and theoretical thinking skills of elementary school children. The content of the invariant modules is supplemented by the variability component that reflects the universal laws and principles of processes in the natural world. The emphasis is on the propulsive force of light and heat. While the seasonal phenomena of nature are explored in the invariability content as conditioned by the change in the fluxes of heat and light, in the variable content they are the basis to explain in a clear way the laws of dialectics, its principles (universal connections, causality, systematicity) and the related values such as moderation, harmony, and order.

In the subject-specific variable content reflected in the curriculum for The ABC of the Natural Laws club for the 3rd grade, the "Development Laws" section explains the law of transition from quantity to quality on examples of inanimate nature, wildlife and human life, by experiments and through long-term independent learners' observations. In the Inanimate Nature module, the "Water properties in liquid, solid and gas states" section traditionally includes a demonstration of the experiment of the transfer of water to steam when heated and to ice when cooled. According to dialectics, this is an abrupt process. The experiment of water evaporation from soil is demonstrated during the classes of the club. It is accompanied with information that in natural conditions, heating the soil leads to evaporation of water from it, dehydration makes soil dry and can lead to desert formation. At a later stage, children learn to visually determine the soil moisture and predict the period of its watering for a variety of plants. In the Living Nature module, when studying the development of a butterfly from an egg through a series of stages to adulthood, leaps in development interleaved with periods of hidden changes are visually demonstrated. Interested children continue to explore this topic independently in the form of the research project called "Raising a butterfly from a caterpillar at home": they maintain a certain air temperature, care and make observations of butterflies' metamorphosis.

In the Human Being module, a situation is presented when the human body heats up in a hot weather, losing water in the form of sweat, then it overheats, and a person may lose consciousness from a heat stroke. School children are asked to find ways of preventive actions at each stage of the situation. When presenting the material, the meaning of the *moderation* and people's capacity to influence the situation are emphasized if it leads to harmful consequences for nature or people. In general, phenomena or processes are presented in relation to objects of different nature, clarified, expanded and solidified. The core of the variable educational content is the universal values: truth, beauty, peace, love, moral conduct. The core curricula for the Universal Values (1st grade) and Rainbow of Love (2nd–4th grades) clubs include the following modules: Value-Based Attitude to Yourself, Value-Based Attitude to Nature, Value-Based Attitude to the Birthplace. The procedural aspect of the methodological system is represented by the technique of developing personal identity of elementary school children. It includes three stages: introductory and value-developing; nature-focused and cognitive- and activity-related; and human-centered and regulatory- and activity-related.

Harmoniously combining the methods of teaching, moral and environmental character formation and subjective school children's perception (emotional and aesthetic) of natural objects and phenomena in the natural science education of elementary school children, the teacher can appeal to a variety of aspects of learners' personality (emotional and cognitive), engage them in various types of activities (creative, purpose- and purpose- and value-based education), to develop a complex of attitudes: to cognition (as a process of absorption), knowledge (as a result of it), to nature, to themselves.

At the basic stage of education (the 1st and 2nd grades), the teacher's work is aimed at developing the value component of the learner's identity. It is actualized through methods of developing value-based attitudes, such as the methods of contemplation, reflection on wisdom, the methods of cognitive development (brainstorming), identification methods (being in silence, reflection games). Lessons can take place in variety of places: in the classroom, outside (in the forest, park, on the lawn), near water, but the structure remains the same. Consider the following example.

On an autumn walking tour, the phenomenon of leaf fall is introduced through observation. School children observe the beauty of the autumn park, the bright color of the leaves, their falling to the ground, listen to the crunch of leaves under their feet, collect them, reflect on changes in their mood, share thoughts about the beauty of the leaf fall, and record them in a self-observation journal. The overall opportunities are therefore created for involving different sensory channels for one phenomenon: leaf fall. This is the phenomenological approach of the teacher's work. In the classroom, during technology classes or club lessons, children create collections of leaves, make handicrafts of natural materials and wood waste in the style of folk crafts. The teacher creates a situation of knowledge development using the brainstorming method: "Why do plants shed their leaves?"

After children make their assumptions, the teacher summarizes the answers and explains that lower temperatures slow down the supply of nutrients, and plants shed its leaves, flowers, and fruit that are sensitive to cold. Fallen leaves are a fertilizer for the soil. At this stage, the concluded is made that leaf fall is beautiful, good, and beneficial. At the next stage (the 3rd grade), education is focused on developing knowledge and skills that constitute the cognitive component of personal identity of the school child. We continue the topic of leaf fall, but at this stage, we develop the knowledge about the color changing process by plants based on the empirical knowledge the children already have. Plants have a variety of colors. It depends on coloring matters: pigments. For example, the green color of plants is due to chlorophyll. Other pigments cause other colors. The activity of coloring matters depends on air temperature and sunlight. There is much green pigment in plants during warm spring and summer.

In autumn, the green pigment is destroyed under a low air temperature and lack of sunlight. Carotenes and xanthophylls color the plant leaves in other bright colors (yellow, red, and purple). At the same time, lower temperatures slow down all the processes in the leaf cuttings cells, and they die off. And just a light breeze is enough for the leaves to come off the branches and swirl in the air. And for us to admire the leaf fall. In addition to the previously used methods, methods of developing a systemic thinking style are introduced. Consider the example of "Good and bad" game. The class is divided into 2 teams, one of them is to verbalize arguments about the positive features of the leaf fall, and the second team — about the negative ones. Arguments for the group 1 ("GOOD"): the plant shed the leaves that are sensitive to cold; fallen leaves are a fertilizer for the soil.

Arguments of the group 2 ("BAD"): the loss of leaves means the loss of "food factory", in the leaves nutrients are created; harmful substances that were accumulated in the leaves get into the soil and contaminate it. The research method nurtures the ability to see and resolve contradictions.

The third stage of education (the 4th grade) is aimed at developing the regulatory- and activity-related component of the school child's personal identity. Such methods as work in small groups on risk analysis, construction of rules for safe behavior in nature are used. For example, when studying the leaf fall, the following assignments are used:

1. Identify the risks of the leaf fall period for people.

Answers: it is windy, slippery, risk of injury.

2. Outline rules of safe conduct during the fall period.

Answers: watch your step, do not fall into piles of leaves.

Thus, in line with the specific features of personal identity development in elementary school children, a general set of methods for developing values, value-based attitudes, and identification is used at each stage; and the methods of cognitive development evolve as the elements of theoretical thinking skills develop. To prepare the teachers for implementing the designed content and techniques, temporary creative groups (clusters) are created (14). At the first stage, a subject-specific cluster is created. The key objective of the subject-specific cluster is to methodologically prepare primary school teachers for humanitarization of natural science education through the development and adjustment of the variable content of The World Around Us course, to help them master the technique, its methods and methodological procedures during the collective creative activity and self-development.

At the next stage, an intersubject cluster starts working. The intersubject cluster brings together various groups of participants in the educational process in order to develop intersubject modules and innovative educational projects aimed at ensuring consistency and continuity of the person-developing content of classroom (subject-specific) and extracurricular activities in primary and secondary school. The aspectual analysis of "identification" and "identity" categories (philosophy, anthropology, sociology, psychology) revealed the essence of moral and ecological identification, the structure and content of moral and environmental identity of elementary school children as an integrated personal educational outcome. Learner's personal identity was determined as the complex educational outcome of humanitarization of NCE. The elementary school child's identity includes the following components:

1) Cognition- and purpose-related component (the initial understanding of the basic laws of dialectics, knowledge of environmental and cultural values and environmental and aesthetic ideals; environmental standards in the traditions of Russian peoples, their birthplace, awareness of the harmony in nature, the inherent value of nature, the place of the human being in it, the ability to environmentally assess natural phenomena, a developed although children's, but nevertheless integral concept of nature);

2) Values- and motivation-related component — the ability to experience a sense of harmony with nature, enjoy its beauty, compassionate, the willingness to have an active moral and environmental position, the desire to comprehend

dialectical and ethical categories in relation to natural phenomena, human relations with nature, the need for communing with nature, the interest in researching nature, studying natural sciences);

3) Regulatory and activity-related component (the experience of compliance with ethical standards in relation to nature, assessment and self-assessment of people's behavior and attitude to nature from the ethical standpoint, design (the environmental design, design of behavior models or activities) in line with environmental values, environmental and aesthetic ideals and ethical principles of treating nature, the ability to realize universal and environmental values in real life).

The conditions being created for learners' personality development were assessed by the criteria of humanitarization of the educational environment and the humanization of pedagogical interaction.

5 Conclusions

Overall, this paper indicates that:

1. On the one hand, the state of the problem of NCE of elementary school children, on one hand, includes a trend towards humanitarization in natural science, the methods and practice of teaching the basics of natural science in the elementary school, and on the other hand, a complex of efforts is required to implement it.
2. The analysis of the available research publications and methodological materials in Russian and international scientific schools of thought made it possible to develop the author's own theoretical underpinning for humanitarization of NCE of elementary school children as a complex and open education system
3. Background is provided for the requirements to humanitarization of NCE of elementary school children, namely the need to develop variable subject and character building content and to actualize the subjective reflective and creative position in its absorption.
4. The paper explores the methodological system of NCE of elementary school children based on the idea of humanitarization as an education system and process.
5. The process of personal identity development of the elementary school child and its outcomes are demonstrated on specific examples.
6. Findings from this study are implemented in schools, pedagogical colleges, and higher education institutions.

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