SCIENCE EDUCATION FOR SUSTAINABLE DEVELOPMENT OF PRESCHOOL CHILDREN

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Abstract: Sustainable development is a basic factor for human well-being and a priority for our society today. The sustainable development is another kind of reality and an alternative of problematic and unclear future at a local, regional, national and global level. This report focuses on the science education of children at preschool age – the children's learning is interpreted as aimed at understand, explain and awareness of science knowledge (processes, phenomena, dependencies) under conditions of leading, encouraging and supporting role of the teacher. It is accepted that preschool science education needs to respond to the challenges, that the child, society and nature should be able to function in unity, based on structural-functional dependencies between them. The integral knowledge acquisition, the forming of skills and attitudes are realized through an Inquiry-based learning. Each of the stages of this learning is specified by adapting appropriate strategies / methods for active learning – in this way science knowledge is transferred from the child to society and vice versa, knowledge is upgraded, ideas evolve to "come back" in the child, broken through the prism of other subjects. Inquiry-based learning is based on the creation of a community "teacher – children – parents": in this community, learning through the inquiry facilitates the acquisition of knowledge and leading ideas in science education during the childhood. Sharing emotions and good learning strategies multiplies the effects of inquiring because everyone contributes to the child's learning activity and becomes a conscious "conduit" of science education, projecting to the much needed change in a cultural level in our society for sustainable development.
Keywords: science education, preschool children, Inquiry-based learning, sustainable development

1. INTRODUCTION

The exceptional sensitivity and critical attitude towards the environmental problems nowadays are rather about disagreement with the status quo, than search for alternatives of establishing values. Modern consumer societies' functions more than ever bring about the fundamental issues on the meaning of human existence, on self-knowledge and self-development in their capacity of intrinsic and premising the processes of human adaptation to the environment. In the universal connection "human – nature" the human should be the carrier of spirituality, faith, ideals and beliefs in unity and integrity. The aspects of these challenges are related to the use of natural resources prudently and rationally – if that happens, the human life will improve. Here, education has a key role – it mediates and regulates these processes. At the core of modern science education is that children should understand, explain, awareness the meaning of science knowledge (Angelova, 2020). Identification of their needs requires building of knowledge, based on their prior experiences. This process is related to children's knowledge acquisition, i.e. thinking, reflecting and reasoning should be based on their own experiences, which helps them discover new connections and progress to the next level of understanding. Thus, science education will carry out its social mission – to validate values through discovering the universal truth about the relation "child – nature".

2. PRESCHOLL SCIENCE EDUCATION FOR SUSTAINABLE DEVELOPMENT – NORMATIVE REGILATION

The Law for Pre-school and School Education entered into force in Bulgaria on 1st August 2016. According to Article 69 (1) "Preschool education creates conditions for knowledge acquisition, skills and attitudes forming, necessary for a successful transition from preschool to school education. Science education at preschool age determines the concept of learning from experience, according to the specifics of children's development. The documents which regulate science preschool education are: The State Educational Standard for Preschool Education – Educational field "Environmental world ("World of Nature and its Preservation") and State Educational Standard for Civil, Health, Ecological and Intercultural Education, regulated by Ordinance No 13 / 21.09.2016[1].

In these documents, the level of science knowledge, skills and attitudes is a dimension of children's interaction with nature and the social environment, as well as of the consequences of this interaction. The reinforcement of this idea requires implementation of EU policies on the role of education in promoting sustainable development. According

[1] State Educational Standard for Preschool Education, State Educational Standard for Civil, Health, Ecological and Intercultural Education. Retrieved from: www.mon.bg (13.07.2020)

to the 2030 Agenda for Sustainable Development "All countries and all stakeholders, acting in collaborative partnership, will implement this plan. We are resolved to free the human race from tyranny of poverty and want and to heal and secure our planet. In the opinion of the Committee of the Regions education is the most important element of wide range of processes – it will change in lifestyle, according to the principles of sustainable development and must begin from pre-school age for children… A sustainable development for all: "Europeans value quality of life. They want to enjoy prosperity, a clean environment, good health, social protection and equity"[2]. Therefore, in Bulgaria it is necessary to ensure knowledge acquisition, skills and attitudes formation for preschoolers, which will provide the foundation of their science culture. This means making a transition towards environmentally behavior to achieve science objectives in a comprehensive, but different context.

3. INQUIRY-BASED LEARNING FOR INTEGRAL KNOWLEDGE ACQUISITION SKILLS AND ATTITUDES FORMING AT PRESCHOOL AGE

Preschool childhood is not only preparatory period in human life, but it is valuable in itself, significant and unique in terms of the initial "accumulation" in child's personality. The activity that is purposeful and arranged in particular manner irrespective of its characteristics should provide knowledge "extraction" from the object and its inclusion in new functional relations. The acquisition of quality human experience by preschoolers suggests most of all the cognitive transformation of environment within the particular social cultural and physical context. In the human ontogenesis, formation of cognitive and practical skills and attitudes in children is an expression of peculiarities of their personality and the role of the culturally determined means of interaction with other people as well as the relation with oneself (Dubrovina, 2013).

In order to achieve the objectives of science education for sustainable development, according to the normative set by the standard as a complex frame, the integral knowledge acquisition at the level of visual, refers to:

- water, soil, energy, climate, biological diversity – plants, animals, fruits; environment – Sun, Moon, stars, seasons, nature conservation;
- skills and attitudes forming refer to: displaying, naming, expression, description, understanding, recognition, differentiation, comparison, interconnection.

In this aspect science education for sustainable development at preschool age correlates to leading ideas, especially on the objective existence of nature, unity of living and non-living organisms and evolution and diversity of living organisms. Here, the learning environment has a key role: it is subordinate to the specifics of the education for sustainable development's claims to requirements for authenticity in learning. The realization of the objectives presupposes the choice of a learning environment (context of learning) – it is subordinate to the specifics of the education for sustainable development and requirements for authenticity in learning. Besides the direct effects on the acquisition of specific knowledge, "a major goal of early childhood education is to enhance children's cognitive skills and socialization, prerequisites for future success in schools and as adults" (Wang, et al., 2010: 381). "Some would argue, for example, that all learning is inquiry learning, i.e., it is an active mental process that demands the active participation of the learner. The argument is essentially the same as the argument of those who say that all learning is "constructivist"—another well-used term in many circles" (Anderson, 2002: 2).

In such a community, Inquiry-based learning contributes to balance by engaging learners with active and meaningful activities – children explore and learn by surveying, enrich their experience in problematic context, support their cognitive and metacognitive processes and use effortlessly different recourses. The conducting of Inquiry-based learning for sustainable development is related to the ideas of children participating in the survey of problems, related to air pollution and establishing of conservation initiatives, also expressing a position through exploration and interpretation of processes in the natural environment.

The contributions of this type of learning are expressed in several aspects:

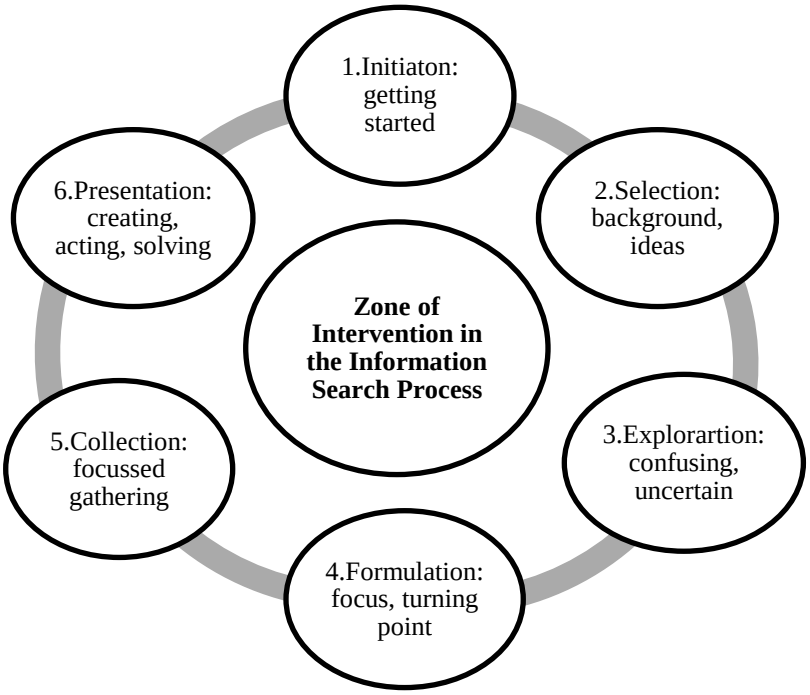
- with regard to the objectives in the Standards – especially for knowledge acquisition, skills and attitudes forming;
- with regard to the ecological and social development of children – by creating a learning community in the relevant context; within the relation "nature – society – thinking", learning is experienced and experience is assimilated by children;
- with regard to scientific knowledge – for the period of pre-school age, this is the exploring, searching, explicating of processes and phenomena in the nature; in this way learning is influenced by the next level of scientific knowledge.

[2] The 2030 Agenda for Sustainable Development and SDGs (2017). Retrieved from: http://ec.europa.eu/environment/sustainable-development/SDGs/index_en.htm (20. 07. 2020).

The leading researchers in the area of child's cognitive development – D. Gyurov, V. Gyurova, R. Gaydova, R. Stamatov, A. Zaporozhets, N. Poddyakov, D. Moshman, J. Flavel, R. Barker, R. Siegler, J. De Loache, N. Eisenberg etc. are focused on the mechanisms of getting to know the reality – knowledge should be organized in such manner that ensures knowledge assimilation. Namely the creation of critical learning environment supporting pre-schoolers' cognitive development lays the foundations of their cognitive structures' functioning and the following development of these structures. The preschool-aged children are capable of associating, recognizing, coding and representing the specific characteristics of the objects. Throughout the process of their development, step by step they perform these processes more effectively thus improving their memory as well as their learning capacities (Siegler et al., 2011; Goswami, 2015).

The choice of methods – role-play games, construction games, conversation, observation, narrative and use of different learning materials and resources – natural materials, posters, encyclopedias, books, ICT recourses, etc., corresponds to the idea of sustainable development. The creation of an Inquiry-based learning environment requires the following sequence of stages (Kuhlthau, 2012) – Fig 1:

Fig. 1. Zone of Intervention in the Information Search Process



The stages are defined as "Zone of Intervention in the Information Search Process". One example for 6-7 aged children is presented below. The learning community is formed by the teacher, children and their parents. The object of Inquiry-based learning is the importance of forests for air purification. First and second zone (the initiation and selection) are happening through a simulation of authentic incidents, which are related to fires, destruction of forests, etc. The teacher uses the narrative method and ICT to engage children's attention with the consequences of negative human activities air pollution, which provokes the necessity to express a personal assumption when putting the problem forward: "How to reduce air pollution?"

The process of generating ideas is related to an analysis of the causes of air pollution and its consequences thereof, including measures to overcome this pollution. The organization of learning environment should contribute to development of creativity, thinking and imagination of children.

The zone of exploration is started with the following question "If we protect the trees from cutting and destruction, this will reduce the pollution and the air will be cleaner". The design of Inquiry-based learning includes evidence-seeking activities to verify the question (hypothesis) – trough a role-play game, the children analyze the tree as a plant – the plant is part of nature. The accent in the role-play game is the tree and its parts – roots, stems and leaves. The leaves of the tree are those parts of the plants, which make the air cleaner.

In a natural environment, for example in the nearby park, in the forest, the children observe trees and their environment. Here they experience learning by exploring the shape, surface, color, size and position of the leaves. The leaf is a small lab – it is a place where fresh air is formed from the dirty air. This lab needs water, soil, sun light. The children say: "The trees absorb water from the soil through their roots, take in dirty air from the environment, and then release clean air". Forests are the lungs of the planet: trees make the air cleaner – this is the focus, the turning point of the problem's formulation. Together with the inquiry of the forest's importance for air purification, children explorer the mechanical composition of the soil – the unique soil structure, stones, rotting vegetation, also the variety of bushes, herbaceous plants and animals located nearby, characteristic of non-living nature. The leading ideas in science education are formulated, more specifically: nature exists objectively, unity of living and non-living organisms, evolution and diversity of living organisms.

Children's parents also join the evidence-gathering activities – at home together with their children, they collect tree data according to their own choice, by especially defining the name of the tree, its shape, surface, size and location, crown type, age, etc. Trees are a source of fresh and clean air, but also a habitat of other plants and many kinds of animals, too. Also, trees have an impact on climate change, by reducing the consequences of this change. The last zone of intervention: a presentation – the results are presented after the assignment has been completed. Children present their results of the exploration in the form of an application, a drawing, a poster. They form attitudes towards nature – they will save the trees, they will take care of them and of nature as a whole. Planning the individual types of interrelated activities could be arranged in the following sequence – Table 1:

Table 1. Interrelated activities of children

Type of activity
1. Cognitive activity – it could be achieved on the grounds of particular educational objective. It is derived from educational part "World of nature and its preservation" in the State educational standard on preschool education and it reflects in view of age capacities and individual needs the particular notions of plants, animals and seasons (their characteristics and changes), cognitive skills for describing, qualifying etc., as well as the attitudes towards environment.
2. Emotional activity – it is based on "teacher – children – parents" community. The design of learning is based on the child's innate needs from competence, relatedness and autonomy as motivating factors for learning
3. Social activity – interaction takes place with the randomized separation of children into pairs or small groups. In the learning also participate the parents of children. Thus we help children develop social skills when performing the assigned task: listening to the other person and accepting others' opinion.
4. Physical activity – moving around maintains children's activity when performing the cognitive task. Children could be situated in group's study-room and in the park for the performance of assigned task while walking, running, jumping

4. CONCLUSION

Change in science education should be initiated from early child age on, with the elaboration of stereotypes thanks to self-expression and self-control. That in turn means new behavioural type of child, aimed at sustainability and hope for a more balanced future. The Inquiry-based learning requires a specific learning environment, organized in a particular way, based on adequate choice of methods, resources and materials. The creation of a learning community "teacher – children – parents", influences the processes of problems' formulating and searching for their decisions, including issues related to sustainable development. Science education has the potential to become an invariant instrument and addresses our society's need of action oriented children and adult at the next stage, capable of delivering better quality life today and in the future.

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