The role of ecological and environmental approach in shaping the architectural environment for preschool education

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Abstract. The article considers the role of ecological and environmental approach in designing the architectural environment for preschool education based on the values of human interaction with the environment. Studying the specifics of designing the architectural environment for preschool education within the framework of the ecological and environmental approach identifies methods of the external space formation focused on children’s playing and providing educational features. The article addresses the specifics of playgrounds formation as the fundamental structural elements of the preschool institution territory for children of each age group taking into account the preschool environmental education. It identifies a range of special features of the building internal space design within the framework of environmental approach. Possible directions are identified for further development of the structural elements of the architectural environment for preschool education taking into account the improvement of efficiency of the environmental education.

1. Introduction
Relevance of the research is supported by expert opinions from different industries recording deterioration of the students’ health regardless of the type of building which is closely related to the environmental situation resulting from the increasing number of motor vehicles. Air and soil pollution, unsatisfactory kindergartens state, reduced motion activity in children. In today’s complex environmental setting, kindergartens and their territory should, first of all, become the environmentally safe areas with minimal negative impact on the health of children and staff, ensure safe use of land and actively shift to nature preservation within the framework of environmental approach.

2. Relevance of the subject
Earlier, studying the formation of architecture for pre-school education buildings was reduced to studying the traditional types of general and specialized buildings. Application of the environmental approach methods to the design of the architectural environment by domestic architects was limited to particular problems identified by A. A. Kuznetsova, I. V. Zhdanova, E. V. Malysheva:
- Standardized sites and poor functional diversity of the territory of a preschool institution;
- Lack of areas for playing, development and learning and experimenting, poor diversity of the environment on the territory of preschool institutions;
- Predominance of artificial elements in the landscape architecture and coatings.
Based on the analysis of the up-to-date projects and scientific articles we can identify the main areas for studying the development of energy-efficient technologies in the design of preschool buildings:

- Minimum use of artificial energy sources (solar thermal energy sources);
- Smooth, streamlined shapes close to natural objects (organic shapes, bionics);
- Construction materials of natural origin (stone, clay, wood, etc.) and after secondary treatment;
- Understanding a building as a live being – breathing, growing, withering, etc. (architecture as a habitat);
- Application of the principles of metabolism, self-development, decomposition, homeostasis in architectural design and construction (synergetic foundations of the development of systems);
- Minimization of the negative environmental impact (design and construction of buildings with closed energy and resource consumption circuits).

The search for an architectural and artistic solution for a preschool building, its space planning design should meet the specific up-to-date purpose, take into account the local natural and climatic conditions, peculiarities of educational activities, construction technology involving modern finishing materials. The most important task for architects is to create an artificial environment that would provide functional and operational qualities at a modern level.

Creation and functioning of the human environment is impossible without the interaction between the natural processes and a man. Therefore, the “human vs. environment” interaction should be considered a single system. At the same time, we should not only talk about the totality of its elements and their visual perception, but also about their relationships, mutual influence, and their functions within the system as a whole [1].

By definition, environment is:

- A system of natural (physical) conditions “inside” which some activity takes place; social and household environment, situation;
- A sum total of people and things associated with common conditions, the substance filling the environment.

These definitions, on the one hand, indicate that the environment is something surrounding something else; on the other hand, that the surrounded is inside something else. This duality is not accidental – in general, the concept implies the unity of the conditions for the existence of an object (process, phenomenon) and the object itself.

The environmental approach will allow transformation of the surrounding space (environment) with consideration of the potential changes in the objects and processes that determine the state and stability of the environment created.

The ecology of space is directly linked to the human ecology, as it affects the quality of life, health, development of abilities, psychophysiological comfort, etc. Environmental problems are constantly aggravating, and the spatial load is tending to maximum (over-compaction, excessive intensification, pollution; unattended, degrading, extreme spaces, their sharp differentiation due to social processes increase the relevance of improving the environmental qualities of the architectural surroundings.

Merging the components of the environmental approach and the ecological approach contributes to the creation of a set of measures for the transformation of space with consideration of the potential changes in objects and processes that determine the state and stability of the environment created for the promotion of interests of the “man and nature” union.

The ecological and environmental approach in the design of the preschool architectural environment contributes to the formation of an architectural space with the qualities of an up-to-date environment that meets the requirements of the modern educational activities promoting the interests of the “man and nature” union. In other words, such an architectural environment should ensure conditions for transmitting the basics of ecological culture to the pupils, careful attitude to and treatment of nature, and have a number of qualitative characteristics resulting from the consideration of the environmental factors and requirements for nature protection.
Preschool age is the most favorable for laying the groundwork for environmental education, natural connections. In this regard, development of the scientific and methodological foundations for architectural design for the ecologically oriented preschool architectural environment is appropriate and quite timely. The need to implement the ecological and environmental approach in design activities is invaluable, as it contributes to the development of protective functions of architecture providing a safe environment, a health preserving space for preschool children.

Implementation of the ecological and environmental approach will contribute to creating a harmonious appearance and contents with consideration of:

- Psycho-physiological peculiarities of a child’s development (age-related needs, physiological capabilities). For example, the need to learn to walk a softly sloped surface (for children under 2 years of age), to slide down a sloped surface (for children under 3 to 4 years of age), to run a sloped surface (for children of 5 to 7 years of age) [2-3];
- Psycho-emotional peculiarities of children’s development (children’s need for a protective space: secluded spots, quiet areas; the need for social contact: active gaming areas, playgrounds for competitions);
- Specifics of educational activities. The task of education, upbringing and socializing in preschool children is currently one of the most prioritized areas related to the modernization of preschool education. This implies the need to improve the preschool architectural environment from the ecological approach standpoint providing the opportunity for the children to lay the groundwork for ecological culture, a conscious and correct attitude to the wildlife and inanimate nature phenomena and objects.

3. The purpose of the research
The purpose of the research is to provide a comprehensive approach to the study of the preschool architectural environment parameters based on meeting the physical and psychological needs of the pupils, educational activities within the ecological and environmental approach.

In this regard, it is necessary to identify and address the following tasks:

- territory-wise, identify the structural elements of the improvement site that have an educational impact from the perspective of the ecological approach;
- for the inclusion of eco elements in the internal structure of the building, identify the significant ones that have educational influence on the pupils.

4. Spatial elements of a preschool educational institution
Environmental safety in the modern architectural embodiment is the formation of a health preserving architectural environment.

Structural elements of the preschool institution territory are:

- Sites for walking, general physical training and themed areas (for learning traffic rules);
- A network of roads and paths and landscaping, that is, elements mandatory for the educational process in a preschool institution.

For the efficiency of education on forming a health preserving environment in a preschool institution, the following means can be used:

- Arrangement of a secure yard by means of a blind fence or half-blind fence, vegetal walls [4-5];
- Creation of compartments, niches through plasticity of the building mass (semi-closed yard resting spaces within the main building mass and utilization of the accessible roof area for playgrounds) [6-9];
- Creation of a protected yard through shaping the building mass or through using an active landscape component;
- Use of shades (the shades can form the perimeter of the site creating a visually impenetrable surface) and due to changes in topography of the site [10-14];
Formation of heterogeneous territory for walking with the means of landscape plasticity. To maintain a healthy environment, one needs to think about the formation of areas from the perspective of landscape arrangement. The concept of landscape is loaded with content more than the word “territory” which main characteristics are valuable only in size. Landscape is full of materialized events of the natural and social world, it is created and objective;

Use of the elements of a building as part of landscaping. Thus, the superstructure can bear the functions of an informal social space for games and meetings of pupils, of a center of attraction for students uniting all kindergarten groups in a single complex.

Preschool institutions continuously search for new forms of laying the groundwork for the environmental culture in children and for the development of environmental culture in adults [15]. In this regard, it is important to determine the possibilities of establishing an environmentally oriented architectural environment on sites intended for children of different age groups according to their mental and physiological characteristics. Individual elements of the site landscape arrangement are:

- Gaming elements made of organic materials (remnants of wood, old trees, etc.) which is attractive due to low cost and high information and artistic potential; suitable for children of 5 to 7 years;
- Coating of various types (gravel, sand, chips, pebbles, etc.) both on the ground surface and on facades which contribute to the development of tactile perception especially significant for children of early preschool age, 1.5 to 3 years;
- Creation of an ecology trail at the stage of design which contributes to the emergence of ecological culture in the preschool children.

“Ecology trail in an educational institution is a place for acquiring knowledge and promoting correct behavior within a natural community... Properly organized nature protection activities on the ecology trail allow pupils to reveal their creative abilities, combine mental and physical labor in studying, evaluating the condition of nature and protecting the nature of their native land, which makes it possible to apply knowledge of ecology, biology, geography, chemistry, physics in practice” [16]. Ecology trails are arranged in various preschool institutions more and more often. They differ from the trails in recreational areas by shorter length, compactness and richness in thematic areas. The main functions of the ecology trails in preschool institutions are: cognitive, developmental, training. On such paths, gaming areas with water and sand, landscape amphitheaters, apothecary gardens, flower beds, etc. are often arranged [17]. The value of the ecology trail is diverse: informing, educational for the pupils and employees and parents. At the same time, architects can also contribute to the arrangement of various ecology trails. For example, they can not only design an ecology trail around the perimeter of the building, but also use the accessible roof, partially use the enclosing structures (walls), entrance groups of the preschool institutions, use elevations (solution at different elevations) which can help get a new look at the network of roads and paths at the preschool institution site. The ecology trail allows studying an object from various angles and expand knowledge significantly, contribute to the growth of cognitive interest in the natural world in preschool children. The kindergarten is not a mere collection of structural elements, it should represent a system of objects distinguishable by age groups and preferences, connected within the ecology trail in a logically organized space being the source of comprehensive development of each child which forms the necessary personal qualities in a preschooler with a teacher’s support.

Thus, architecture plays a neutralizing protective role and serves to educate environmental culture, transmit correct attitude to the environment, phenomena and objects of the wildlife and inanimate nature to the pupils.

5. Internal structural elements of the building formed within the framework of the ecological and environmental approach

Consideration of the architectural environment for preschool education within the framework of the ecological and environmental approach would not be complete, if the kindergarten building mass itself is excluded and it was limited with only the territory and environment. A kindergarten is understood as
a secured oasis where a child acts as a co-creator of the environment and nature is an ideal “partner” for co-creation [18]. Therefore, the architecture of a preschool institution should contribute to the daily desire of children to communicate with nature. This can be facilitated by the inclusion of the following components in the structure of a preschool institution:

- Minimum use of artificial energy sources (solar thermal energy sources), maximum use of natural ventilation, solar panels (which can provide up to 40% of the required volume of electricity), use of rainwater collection systems for household needs and plant irrigation (allows to reduce the load on the central water supply more than twice). Lighting and air conditioning systems provide an excellent microclimate inside the building. An underground gym is heated with geothermal heating, so-called alternative technologies allowing the use of inexhaustible sources of heat without harming the environment. Geothermal heating is based on the operation of a heat pump which principle of operation resembles an ordinary refrigerator. But if a freezer intakes heat from the interior, the heat pump, on the contrary, intakes heat from the environment and directs it to heat the building. Geothermal heating is an environmentally friendly solution that does not require a combustion process, therefore, no combustion products enter the atmosphere;

- Active use of original structural peculiarities in the construction of buildings, like the kindergarten from Mario Cucinella Architects, Italy. Peculiar wooden “ribs” form the base of the building. Spaces between them are covered with glass panels which ensure its full integration into the surrounding landscape. Moreover, in some places, like at the entrance, they are left open and trees literally grow through the structure almost completely erasing the already shaky line between the environment and the interior. Changing dimensions of the “slots” on the end side of the building form a dynamic internal space and define a strict, well-thought-out sequence of training, gaming and communication areas. Visually, a gallery of such curved arches creates the illusion of an endless cave;

- Positive energy of natural wood and a calm color scheme in the preschool institution interior contributes to the creation of a favorable environment and allows children to explore the surrounding world with comfort;

- Inclusion of integrated plant modules in the spatial structure with an autonomous system for maintaining optimal microclimate, as well as active use of verandas/waiting areas;

- Inclusion of safe and accessible green roofs and slopes, grounded parts which contributes to the formation of surfaces for the development of coordinated movements of pupils, holding collective games (competitions), as well as downhill skiing (in winter) during a walk. Consideration of this element for potential dialogue between a child and the environment is only possible when the element is accessible to children (arrangement of the roof operated from ground level through the formation of slight slopes over any room in the whole building mass). The slopes and grounded parts of the building contribute to “merging the architectural form with the background (environment) suppressing the contrast by similarity, camouflage and dematerialization of the architectural form” [18] which is especially important in a megalopolis;

- Use of phytotron shells on the roof: autonomous, environmentally friendly, recreational and educational spaces rich with vegetation and allowing the creation of conditions for an optimal microclimate [19-20] which also contributes to partial compensation of green areas on the territory;

- Addition of amphitheater-like platforms to the structure of a building forming small staircases-amphitheatres. Increasing the number of natural areas, gaming elements made of natural materials (wood, stone, sand, etc.), expanding opportunities in viewing natural objects – different points of perception, creating conditions for educational, creative and sports activities – improve the comfort of children’s stay at preschool institutions, contribute to ensuring a safe, health preserving and ecologically oriented environment.
6. Conclusion

Environmental safety in the modern architectural embodiment is a difficult task for an architect. Taking into account the above components of the architectural environment for preschool education in terms of the formation of the building mass and improvement of the territory will not only create an economically profitable construction project, but also make any designed facility unique and original thus ultimately increasing the degree of self-identification of the preschool institution in its environment and forming new components of the spatial architectural environment and the building mass.

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