

Algorithms as a Tool for the Formation of Design Skills of Preschool Children in the Digital Educational Environment

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ABSTRACT

The life of a modern person is full of various electronic devices, structures and technical means. In this regard, one of the key tasks of the modern education system is the creation of a digital educational environment, within the framework of which the intensification of cognitive-research and design activities of children, their development of interest in invention and creativity will take place. The relevance of the problem investigated in the article is due to the prevailing need to expand the content of preschool education, the possibilities of using new digital and information technologies in design, and the inevitability of changing the role of the teacher in connection with emerging opportunities, the potential of using design to develop thinking, imagination, initiative of preschool children, to form universal prerequisites for educational activities. In the federal state educational standard for preschool education, various types of children's activities are identified, which should be developed in kindergarten. One of the main types of children's activities is the construction of various materials. The result of any activity of the child depends on how much he imagines the algorithmic essence of his actions, which is very important in the process of design activity, since algorithmic skills allow you to break down complex actions into simpler ones and achieve the desired result through a strictly organized sequence of actions. Thus, the objective of this study is to show the possibility of using algorithms in the process of forming design skills in preschool children. Based on the analysis of psychological, pedagogical and methodological works, the structure of design skills of children was determined, which consists of procedural, regulatory and communicative blocks. A technique has been developed for the formation of design skills in preschool children, consisting of three stages: teaching children to design according to the model, constructing according to the condition, designing according to the plan. Based on the totality of design skills highlighted in the study, three levels of the formation of these skills in preschool children were determined: the creative level, the level of construction according to the condition, the copying level.

Keywords: *digital educational environment, design skills, algorithm, preschool children*

1. INTRODUCTION

Currently, there is an intensive development of science and technology, which has a significant impact on the education system. The formation of a new all-Russian educational environment is associated with the program for the deployment of the federal center of digital educational resources (FCIOR) for the system of preschool, general, professional and additional education, the state program of the Russian Federation “Development of education” for 2018 - 2025, which includes the priority project “Digital educational environment”, which is aimed at creating the conditions for the implementation of a modern and secure digital educational environment that ensures the formation of

values for self-development and self-education of learning educational organizations of all types and levels. The problem of the development of digital education in Russia and abroad is revealed in the studies of Borisenkov et al. [1], Kolbachev et al. [8], Rozina [13], Broadbent et al. [2], Glasby [7, p. 14], Roberts et al. [12], Witecki et al. [15] and others. Digital technologies are an effective means for solving the problems of developing training and implementing an active approach at all levels of education. One of the mechanisms for the implementation of the activity approach at the level of preschool education is the activation of cognitive-research activities of preschool children, the development of their interest in invention and creativity. A key role in this process is given to design, which, according to the requirements of the Federal State Educational Standard for Preschool Education, is one of the main activities of preschool

children. In the process of designing, a preschooler develops thinking, independence, initiative, search activity, develops a desire for experimentation, creativity, the child learns to plan his activities to achieve his goal, follow instructions, work according to the model, the prerequisites for educational activity are formed. These skills help him to adapt better to the modern rapidly changing technological world.

2. STATEMENT OF THE PROBLEM

Unfortunately, the modern system of preschool education is not ready to fully meet the requirements of society. This situation is caused by a number of factors, among which a certain role is played by the fact that in modern programs of preschool education little attention is paid to the formation of design skills of children with the help of algorithms, however, the algorithmic nature of the design and the possibility of using new digital technologies and lego construction in the process create conditions for the development of logical, creative thinking, speed of thinking, the ability to find solutions arising in the process of activity and difficulties. The teacher, teaching children in kindergarten how to count, solve problems, measure values, retell stories, describe illustrations, etc., tells them the necessary rules about how, in what sequence the task needs to be completed and what the outcome of the actions should be. The result of the child's activity depends on how much he imagines the algorithmic essence of his actions, which is very important in the process of completing design tasks, since algorithmic skills allow you to break down complex actions into simpler ones and achieve the desired result through a strictly organized sequence of actions. Thus, the objective of the study is to show the possibility of using algorithms in the process of formation of design skills in preschool children.

3. RESEARCH QUESTIONS

In order to solve the problems posed in the study, the authors consider it appropriate to consider the following issues:

- clarify the concept of design skills of preschool children and highlight their structure;
- to develop a methodology for the formation of design skills in preschool children in a digital educational environment using algorithms.

4. PURPOSE OF THE STUDY

The aim of the study is to develop a methodological base for the use of algorithms for the formation of design skills of preschool children in a digital educational environment: determining the essence of the concepts "design activities of preschool children", "design skills of preschool children", determining the structural composition of

design skills, identifying stages and determining the means of their formation.

5. RESEARCH METHODS

Research methods: terminological analysis, synthesis, comparison, comparative analysis, systematization and generalization.

6. RESEARCH RESULTS

In the psychological, pedagogical and methodological literature, it is noted that design is of great importance for the development of the personality of a preschool child. So G.A. Uruntaeva [14] established the influence of design on the development of children's thinking. It develops the visual-figurative thinking of preschoolers, due to the fact that the construction of various crafts, models begins with an analysis of the subject, during which children establish and determine the structure of the object and the relationship of its parts, track the logic and methods of their connection.

N.A. Menchinskaya [9] notes that construction is one of the means of preparing a child for learning activities at school, forming his mental activity, the ability to reason, make logical conclusions and substantiate his decisions. Construction contributes to the development of the mental activity of preschool children, teaches to independently formulate goals and find ways to achieve them. The child performs mental operations necessary to achieve the goal. Analysis of studies (Vygotsky [4], Davydov [5], Zaporozhets [6], Paramonova [10], Poddyakov [11], Uruntaev [14], Elkonin [16]) showed that children's construction is understood as the creation of various designs, constructions of models by children from the details of designers, building materials, paper, cardboard, natural material (cones, moss, branches, stones), waste material (wooden reels, cardboard boxes, rubber tires). The material that is used in the design process and determines its appearance. They distinguish: construction from building materials, from bulky modules, paper, cardboard, natural material, waste material, designer parts, game building materials.

Currently, there are many different design kits designed for all age groups of the kindergarten: desktop, for games on the floor, in the yard. Among them are thematic ("Architect", "Cranes", "Young Shipbuilder", "Bridges", etc.), which are used as an independent type of material for construction, and sometimes as a complement to the main building kit. In addition to building kits, "Constructors" are used, having more durable connection methods.

Modern kits are LEGO constructor kits, magnetic kits of the MAGFORMERS and GEOMAG type, gear type kits of the QUERCETTI, the hinged kit of ZOOB, the CLICS kit, the BRICKS kit. Velcro kits like "BUNCHEMS" have gained great popularity. Also, in the practice of modern

kindergartens, robotic kits such as “RoboLab Education”, “LEGO Education” are used.

In kindergarten, two types of construction are used - technical and artistic. Construction from building material, parts of kits, large-sized modules, as well as design based on computer programs - these are types of technical design. Art design includes paper construction and natural material construction.

Game activity is leading among children of preschool age. Applying construction in the game, the preschooler translates the objective situation into a mental one through visual, verbal images and vice versa. In the process of constructing, children learn to plan their actions, build a sequence of operations necessary to solve the problem posed in the game. They explain their actions to peers and adults, building coherent speech, using special terminology, learn to evaluate the actions performed, their appropriateness, achieving the desired result. They form an idea of the integrity of the model manufacturing process, construction, crafts from design to the final product. In the end, they form the ability to mentally play, without performing specific actions, the future practical situation. This skill plays a huge role in the learning process, when the child occurs in a situation of finding a solution to a particular educational or practical problem, finding a way to discover knowledge, etc.

After analyzing the concepts of “activity” and “construction”, we defined design activity as a productive activity aimed at solving a specific structural and technical problem, providing for the organization of space, establishing the relative position of elements and parts of objects in accordance with a certain logic aimed at creating models, crafts, structures, various items from materials available to the child. In the process of development of design activity in preschool children, design skills are formed - this is the ability of a preschooler to carry out design activities.

Based on the analysis of psychological, pedagogical and methodological works, the structure of design skills of preschool children was determined, which consists of process, regulatory and communicative blocks.

The process block includes: the ability to analyze the sample, dismember, highlight the components of the object that needs to be collected; the ability to assemble an object from parts, individual parts according to the scheme, algorithm, model, design; the ability to plan design activities to create the desired object; the ability to encode and decode information through the construction of an algorithm, schemes for performing actions when constructing an object.

The regulatory block contains: the ability to control the correctness of the actions performed in the design process; the ability to make corrections to the results of one’s activities to correct inconsistencies with the sample; ability to evaluate the result.

The communicative unit includes: the ability to describe one’s activities in the construction process with accessible language means; ability to carry out joint design activities; the ability to negotiate with peers and adults, to distribute roles in creating the object.

Only on the basis of complex, formed, generalized design skills can preschool children form new original, creative actions in the design process. In the unity of knowledge, elementary abilities, skills, general (creative) skills, the child’s art and design activity is formed, the preschooler displays a conscious, proactive attitude to cognition and transformation of the surrounding reality in the process of construction.

Based on the proposed N.N. Poddyakov [11] types of design activity (1 type - designing according to the model, 2 type - designing on the condition, 3 type - designing according to the plan) we developed a method for the formation of design skills in preschool children, consisting of three stages.

At the first stage, it is necessary for children to form generalized methods of activity that facilitate the creation of various objects. Preschoolers should familiarize themselves with the sequence of design creation (goal-setting, planning, plan implementation, reflection). They must be taught to design according to the model, pattern or instructions of an adult.

Given that any design has an algorithmic structure, we suggested that when forming design skills, the most effective learning tool is modeling algorithms that reflect the sequence of creating an object. An algorithm is one of the ancient, fundamental concepts of mathematics. In connection with the digitalization and technologization of the modern education system, it is necessary to begin to formulate algorithmic skills in children already in preschool age [3].

There are three types of algorithms: 1) linear, in which the sequence of actions is performed in a strictly defined order, once; 2) branching - characterized by the fact that there is a condition that needs to be checked, and if it is satisfied, then one sequence of steps is executed, if not, then another; 3) cyclic - contains part of the actions that must be repeated several times until some condition is realized.

Thus, at the first stage of the methodology for the formation of design skills of preschool children, they are taught to create an object in the process of construction according to a scheme presented in the form of an algorithm, first linear, and then branching and cyclic. This is the model design.

To implement the tasks of the first stage of the methodology, a set of special exercises and tasks was created: designing according to a plan, an algorithm that the teacher gives to the children step by step; construction according to the finished scheme, plan, algorithm, which is depicted in the form of a block diagram; analysis of crafts, construction, the finished model under the guidance of a teacher, determining the components of this object, selecting the necessary details, initial planning of the upcoming design activity (what needs to be done first, then what will be the final action), then the children are offered a design algorithm that preschoolers implement .

The main objective of the second stage of the developed methodology is the formation among preschoolers of the ability to plan their upcoming design activities, based on given conditions, guidelines - constructing by condition.

Children first complement, transform the construction algorithm, and then learn to independently compose an algorithm, a diagram of the object that they create.

To implement the tasks of the second stage of the methodology for the formation of design skills, special exercises and tasks are used: determining missed steps in the algorithm, scheme for creating an object; complementing the algorithm with two, three actions; transformation of the created object construction algorithm in order to change the construction according to the conditions; the creation of simple algorithms, including in the digital educational environment, schemes for constructing crafts for preschool children according to the model in which the details of the created object are visible.

At the third stage, the integration of design with other types of children's activities, the creation of conditions for independent transformation by children of previously studied designs, for children's creativity in the design process. This stage is characterized by design by plan.

The following exercises and tasks are used to implement the tasks: creating an algorithm for constructing an object according to a drawing, in which the details of the kit that make up the artwork, a digital image are not detailed;

restoration of the algorithm for constructing the object according to the given conditions and the construction of the object according to the created algorithm; the use of design in labor, art and other children's activities; transformation of the created object according to the changed conditions.

Based on the totality of design skills highlighted in the study, we determined three levels of the formation of these skills of preschool children: the creative level — the child independently and confidently performs the entire set of actions to create models and structures; independently builds an algorithm for future activities and works on it; the level of construction according to the condition - the child performs actions in external speech, the actions in the construction are abbreviated; the algorithm of the upcoming activity of creating models, constructions is made with errors, which are corrected with the help of a tutor; copying level - the child performs actions in external speech, the actions during construction are expanded; encodes information and builds an algorithm for creating a model only in conjunction with the educator.

7. CONCLUSION

Designing is one of the most interesting, attractive and accessible for preschool children activities. In the process of design activity, children apply their knowledge and skills in practice. Creating a variety of products from accessible materials, constructing images in a digital environment, depending on the given conditions and endowed functions, the child learns to mentally break the model into separate elements (parts), display the structure of objects, convey their appearance and expresses their attitude to them. The child's self-integration of

knowledge, design skills and well-known methods of activity when creating new conditions for the learner to learn the constructions gives a new version of the solution to the problem, and the algorithm helps him to carry out his design work, implement robo-models in a digital environment, create graphic comics stories, combining design and dynamic images on a computer screen. All these skills undoubtedly reflect the modern world, full of operating systems, gadgets, "smart homes", virtual reality systems in which preschoolers grow up.

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