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ПІЗНАННЯ ДОШКІЛЬНИКАМИ ДОВКІЛЛЯ ЗАСОБАМИ ЕКСПЕРИМЕНТУВАННЯ

Анотація. Автори статті обґрунтовують вплив експериментальної діяльності на формування пізнавальної активності дітей дошкільного віку; мотивацію до пізнання довкілля за допомогою інтелектуальних ігор та експериментів, презентовано результати дослідження, у якому взяли участь 83 дошкільників. Представлено результати науково-дослідницької роботи, що підтвердили ефективність запропонованої авторами методики. Виявлено, що в період дошкільного дитинства пізнавальна дослідницька діяльність супроводжується ігровими, продуктивними видами діяльності у вигляді орієнтуючих дій, перевірки можливостей будь-якого нового матеріалу. У дослідженні запропоновано такі аспекти експериментування з дошкільниками: усі схарактеризовані заходи мають бути емоційно забарвленими, викликати в дітей позитивні емоції та бажання діяти; для дітей дошкільного віку актуальний прийом повторення; багато видів діяльності можна і варто повторювати в процесі роботи; одночасно можна розглянути один із елементів об'єкта в різних його поєднаннях або один об'єкт з різними властивостями.

У процесі дослідження встановлено, що використання експериментування дає змогу ознайомлювати дітей із конкретними методами дослідження, із різними методами вимірювання, із правилами безпеки під час експерименту. Діти спочатку за допомогою дорослих, а потім самостійно виходять за межі набутих знань та навичок, спеціально організованої діяльності і створюють новий продукт.

Ключові слова: дошкільники, експериментування, довкілля, заняття, здібності, методи, педагог.

ENHANCING ENVIRONMENTAL COGNITION BY PRESCHOOLERS THROUGH EXPERIMENTAL ACTIVITIES

Abstract. The paper focuses on the issue of environmental cognition by preschool children via experimental activities. The emphasis is placed on the role of motivation, intellectual games and experiments in children's perceiving the world. The article presents positive results of the pedagogical experiment (in which participated 83 preschoolers) that proved the effectiveness of the devised methodology. In the article, it is posited that early-age experimentation implies a simple manipulation with things, at which children perform the operations of differentiation, and categorization under various conditions. Specifically, these operations presume simple actions with objects, which vary in color, shape and size. Moreover, preschoolers use different sensory channels to perceive the objects around them. The study maintains that in the junior preschool period children's cognitive activities are accompanied with role-plays, games, and orientation actions aimed at testing new objects, while senior preschoolers perform similar activities experimenting with objects and employing verbal means like questions why, what for, and how? The study propounds the effective techniques of experimentation with preschoolers, which embrace



creating a positive learning environment, employing emotionally colored forms of instruction, maintaining in children a high level of motivation for actions, and using repetitive and suggestive tools.

In the course of research, it has been revealed that experimenting is targeted at familiarizing preschool children with specific methods of cognition, measurement tools, and appropriate safety rules, which allow preschoolers to broaden their knowledge and acquire necessary skills in order to be able to create new products independently within specially organized learning activities.

Keywords: preschoolers, experimental activities, environmental cognition, classes, abilities, methods, teacher.

INTRODUCTION

The problem formulation. In modern educational practice, the importance of preschool experimental teaching is increasing. This is due to the dynamic development of society, the penetration of new levels of knowledge of the nature, the change of social structure and the emergence of new types of activities in previously unknown industries. Experimental activity is an activity related to the solution of a creative, research problem with a previously unknown solution, which assumes the presence of the basic stages characteristic for research in the scientific field, normalized, based on accepted traditions in science.

Experimental activities will allow expressing child's individually or in a group, show publicly achieved results. This activity is aimed at solving a specific issue, often formulated by the children themselves in the form of a problem, when the result of this activity – a found way to solve the problem – is practical, has important application value and, very importantly, interesting and meaningful for the discoverers themselves.

Analysis of recent research and publications. In the study, we rely on the results of foreign researchers on the problem of using experimentation with preschool children. In recent years, research on solving problem has become very popular. K. Anderson and A. Gullberg discussed studying science in preschool. One of the example of exploring preschool children's science content knowledge is presented in the work of Ying Guo, Shayne B. Piasta and Ryan P. Bowles. The most interesting approaches to this issue has been proposed by Dziengel Ana, T. Tu, L.French.

To understand preschool children's science learning, it is also important to identify potential predictors of science competency, because the identified factors could aid in determining which preschool children may struggle with learning science content knowledge and experience downstream science learning problems as they matriculate into elementary school and beyond (Ying Guo, Piasta, Bowles, 2015, p.125).

The current situation of human development is a situation of non-standard, uncertain tasks, a situation where one has to act with unreliable information, to take into account the perspectives of real and potential partners. It requires that each individual search attitude to the outside world. The fundamental feature that determines the specificity of human cognitive activity in modern conditions is that there is a constant need to manage many new and diverse objects and phenomena related to each other at once. Therefore, a different system of organizing cognitive activity is now needed – of a higher quality. A modern child must actively explore the novelty and complexity of the changing world, create, and invent new original strategies for behavior and activity (Dziengel, 2012). This active cognitive attitude to reality must be shaped from childhood.

THE PURPOSE OF THE RESEARCH – are to analyze the problem importance of preschool experimental teaching; highlight its theoretical aspects; outline the scope of its practical application in preschool education.

RESULTS OF THE RESEARCH

The fundamental ideas on which research is based can be attributed to the pedagogical principles. We started by investigating of them. The principle of orientation to the cognitive interests of the child. Research is a creative process, creativity cannot be imposed from the outside, it is appeared only based on an internal need, in this case, a need for knowledge.

The principle of freedom of choice and responsibility for one's own learning. Only if it is implemented can education be adequate to the individual purpose of the individual.

The principle of assimilation of knowledge in unity with the ways of their assimilation. The approach to the formation of the scientific picture of the spiritual and moral world order, which is determined by the tasks of research teaching, involves not only the assimilation of a certain amount of information obtained through special researches, but also the need to obtain new knowledge on the basis of mastering the ways of its discovery. Science is inseparable from the reflection of the way in which knowledge is obtained, so the young researcher must not only acquire in the product in the form of some positive knowledge, but also be well aware of the evolution of knowledge, as well as – ways and means of obtaining it (Fleer M., Gomes J., March S., 2014, p. 38).

Principle of reliance on the development of self-seeking information. The main task of modern education is not only the communication of knowledge, but, first and foremost, the development of the child's needs and abilities to acquire this knowledge. Only on this basis can the child transform the knowledge into a tool for creative development of the world.

The child does not simply consume information, but generates knowledge itself. The knowledge offered for learning a child in traditional education is new to her. In circumstances where the main value of education is not knowledge, but ways of obtaining it, it becomes irrelevant how new the information obtained by the child is.

The principle of combining productive and reproductive teaching methods. The psychology of learning indicates that it is easy and involuntary to absorb the material that requires active thinking, but not everything that is necessary to learn a child in education; it should open during independent search (Tu, 2006, p.246). Therefore, the use of research teaching



methods should be combined with the use of reproductive methods. Moreover, the work of any researcher has traditionally many tasks of a reproductive nature, which may be considered routine but do not become unnecessary.

Requirements for the teacher

The role of the teacher in experimental learning differs significantly from that which it performs in traditional teaching, which is based on the predominant use of reproductive teaching methods. The teacher, prepared to solve the problems of research training, must possess a number of characteristics; it must master a set of specific skills. The main ones are:

- be sensitive to problems; be able to see "the amazing in the everyday"; to be able to find and set before children real educational research tasks in a form understandable to children;
- be able to capture children with a didactically valuable problem by making it a problem for the children themselves;
- be able to fulfill the functions of coordinator and partner in research;
- by helping children, be able to avoid directives and administrative pressure;
- be able to be tolerant to the mistakes of children who are allowed by them in trying to find their own solution; offer your help or address the right sources of information only when the child begins to feel the hopelessness of his or her search;
- organize activities for observations, experiments and various "field" studies;
- provide ongoing reporting to working groups and exchange views during open general discussions;
- encourage and develop critical thinking about research procedures;
- be able to stimulate suggestions for improving the work and promoting new, original research areas;
- carefully monitor the dynamics of children's interests in the problem under study; be able to finish experiment and work on discussing and putting solutions into practice before signs of loss of interest in the problem appear in children;
- be flexible and, while maintaining high motivation, allow individual children to continue to work on the issue on a voluntary basis while other children are finding ways to solve a new problem.

The game in experimental activities

An indispensable childhood companion and the most important tool of the game is a toy. From the first months of life, it holds a special place among the objects that surround the child. It is often the vehicle and the subject of the first of its own research. The game is one of the most interesting types of human activity, a leading activity of the preschool child, a means of its comprehensive development, an important method of education, a real social practice of preschoolers. Children's game is an activity aimed at orientation in the subject and social reality, in which the child reflects the impression of their knowledge (Polevikova, Shvets, 2019, p.326). We usually offer a child a toy that is not designed to be actively explored (disassembled, broken, etc.) by its potentialities and contents. In addition, the desire of the child to use a toy in the program of its own research activities leads to the fact that it is thrown, drowned in water, buried in the sand, disassembled. All this usually causes the toy to become unusable. In some countries, there is a strict rule: in no case should you punish your child for broken toys.

At first glance, it may seem like an easy way to solve the problem – you need to create toys that you can do anything with. We need toys that can be disassembled and assembled, that is, toys that are capable of transformation, so that their capabilities and devices can be studied without rendering them unusable. This is indeed a way of solving the problem, but technically, it is extremely difficult.

There are alternative and very productive ways. One of these ways is to give the preschooler a minimum of ready-made toys, to try to make its game with toys that it made itself. Another option is to let the child find its own toys among the objects that surround it. Therefore, we must admit to its that it considers toys all the objects with which it comes into contact. Research shows that ready-made toys often bring more harm than good to the child's development. Ready-made toys that please the eye of the adult often do not allow the child to realize its search activity, to mobilize fantasy. They are only interesting for some time.

Many observant educators and parents know that often the expensive, new toy from the store is inferior to the competition for the child's attention to a simple glass or pebble, wooden bars or unknown metal objects, fragments of old utensils or pieces of foam (Polevikova, Tsyupak, Shvets, 2019; Polevikova, Shvets, 2019). It is no an accident – a child by nature – a researcher. It is much more interested in the fact that it has no rigidly fixed functions, and therefore can be used for a variety of purposes. When depriving a kindergarten or apartment of this kind of garbage, we also often restrict children's research.

The most interested preschooler is playing with toys that give to it the "joy of achievement" (Anderson, Gullberg, 2012, p. 291). To try them, children are usually offered not sets of toys, but sets of parts from which they can assemble the toy themselves. From them you can do something new, unusual, they can be used for different purposes.

Promoting and counteracting research behavior is widespread. With this in mind, one has to overcome stereotypes and learn to look at traditional educational activities from a new perspective. However, it should be kept in mind that this opposition has its positives as well. Society impedes the acquisition and dissemination of experience, which destroys its moral foundations and cultural values, such as the experience of socially abusive habits (smoking, drugs, etc.), age restrictions on the acquisition of sexual experience and knowledge, the dissemination of criminal activity (Conezio, French, 2002, p.12). Education should prevent the dissemination of experience that is considered false or outdated.



The most interesting thing is that counteracting research can foster personal growth and development. Moreover, it is not just the well-known sweets of "forbidden fruit". In humanistic psychology, there is a special term – "hyper compensation". This is the ability of the individual to withstand the circumstances of society and to develop against them. The task of a successful personality – the development of personal qualities, as well as the development of intelligence and creativity – inevitably requires that the child learn to overcome difficulties and obstacles. From this point of view, not only the promotion but also the counteraction should be considered favorable.

Educational research by a preschooler, as well as research conducted by an adult researcher, inevitably involves the following elements:

- and statement of the problem (choice of research topic);
- hypothesis development;
- search and offer possible solutions;
- collection of material;
- analysis and synthesis of the received data;
- preparation and protection of the final product (message, report, layout, etc.).

During the experimental work on creating and refining the methodology, it has been repeatedly noted that for many educators, the idea that a child is able to go through all these stages, at first glance, seems doubtful and even frightening. However, these fears and doubts dissipate as soon as the real research work with the children begins. Note that in order to simplify, it would seem that one can shorten one of the steps. Nevertheless, looking carefully at these stages, you can no doubt understand that this will significantly impede the process, and therefore the pedagogical result of the work (Adúriz-Bravo, 2012, p.1593).

The results show that it is especially important to remember that at all stages of this work, we should be clearly aware that the basis of the expected progress is the development of creative abilities, the acquisition of new knowledge, skills, research skills and processing of the material obtained. In no case should it be confused (the result) with that product that is made, because of the work of a small researcher. More precisely, we must bear in mind that in this case we are dealing with not at least one "result" but at least two. The first, of course, the most important, let us call it pedagogical. The second is the one that creates a child with its own head and hands – layout, project, report, etc.

For the teacher, the main result of this work is not just a nice, detailed scheme, a message prepared by the child, a "technical drawing" or even a paper-made layout. The pedagogical result is primarily an invaluable educational experience of independent, creative, research work, new knowledge and skills, a whole range of mental tumors that distinguish a true creator from a simple artist (Ekerblom, 2015, pp. 3–4).

Mental experiments (games) are quite widely used in teaching children research. Psychologists call these games mental experiments. Mental games help children acquire the skills of research and development of divergent thinking: the ability to see problems and hypothesize their solutions (Erduran S., Dagher R., 2014). This kind of thinking is closely related to the imagination and is a means of generating many original ideas. Among games for preschoolers are the different. The examples of the games illustrated below.

Infusion of soap bubbles.

Objective: To teach how to make soap bubbles; to be acquainted with the fact that when the air enters a drop of soap water forms a bubble.

Materials: Plate (tray), glass funnel, straws, sticks with rings at the end, soap solution in the container (do not use toilet soap).

Experiment progress.

An adult pours into a plate or a tray of 0.5 cups of soap solution, puts an object (for example, a flower) in the middle of the dish and covers it with a glass funnel. Then blow into the tube of the funnel and, after the formation of a soap bubble, cants the funnel and releases bubble from under it. The plate should have an item under the soap dish (you can blow through a small bubble into a large bubble with small bubbles). An adult explains to children how the bubble leaves, and invites them to infuse themselves with soap bubbles. Together, they consider and discuss: why increased in size bubble (there penetrated the air); where did the air come from (we breathed it out from ourselves); why some bubbles are small, and others are large (different amounts of air) (Polevikova, Tsyupak, Shvets, 2019, p.280).

Wood, its quality and properties.

Objective: To learn to recognize things made of wood to distinguish its qualities (hardness, surface structure – smooth, rough, degree of strength (thickness) and properties (cuts, burns, does not break, does not sink in water).

Materials: Wooden objects, water tanks, small boards and bars, alcohol, matches, knife.

Experiment progress.

An adult shows a few wooden objects and asks the child what they are and what they are made of. Offers to determine the quality of the material. The child receives a board and a bar, feels them, and makes a conclusion about the structure of the surface and thickness. To detect properties, lowers the bar into the water (does not sink); tries to refract it (does not work – means strong); drops to the floor (not beating). The adult cuts a small figurine out of the bar and focuses the attention of the children on the fact that it takes considerable effort to perform this work. Demonstrates burning wood. Determination of household items can be made of wood.

To illustrate the result, in our research, we invited 63 preschool teachers who were teaching kids with a use of experiments. At the beginning of the research, we made the analysis of the understanding the environment before using



the experiments in preschool classes. We were testing over 83 preschoolers for getting the results for our research. The overall measurement results of analyzing the understanding the environment before using the experiments in preschool classes are summarized in Table 1.

Table 1

The results of analyzing the understanding the environment before using the experiments in preschool classes (in rates)

Levels of the understanding the environment before using the experiments in preschool classes			
elementary	pre-intermediate	intermediate	upper intermediate
25	64	8	3

Then we started to use experiments and mental game to explain the environment. All the types of children's activities, which were explain previously, helps to improve preschoolers' level of understanding the environment. The results of analyzing the understanding the environment before using the experiments in preschool classes are presented in Table 2.

Table 2

The results of analyzing the understanding the environment before using the experiments in preschool classes (in rates)

Levels of the understanding the environment after using the experiments in preschool classes			
elementary	pre intermediate	intermediate	upper intermediate
18	47	24	11

Of course, a very significant impact on the effectiveness of the individuality of the teacher working with preschoolers. The obtained data confirm the positive dynamics in the understanding the environment with the use of the experiments in preschool classes.

However, such a positive dynamics is associated with the use of various ways of experimental activity with preschoolers. Cognitive research is started in early childhood, and initially is a simple experiment with things, during which differentiation of perception, there is a simple categorization of objects by color, shape, purpose, mastered sensory standards, simple object actions (French L., 2004, p. 139).

In the period of preschool childhood, the "island" of cognitive research activities accompanies game, productive activities in the form of orienting actions, testing the possibilities of any new material. Cognitive research activities of the senior preschooler is manifested in the form of children's experimentation with subjects and in the form of verbal research of questions posed to the adult (why, why, how?).

The value of research for children:

- enriches the memory of the child, activates her mental abilities;
- the child's speech develops;
- there is an accumulation of an arsenal of mental techniques and operations;
- independence is formed and developed, the ability to transform any objects and phenomena to achieve a certain result;
- developing the emotional sphere of a child, his creative abilities.

Studies allow the child to find the answers to the questions "how?" and "why?". This is a great opportunity for children to think, to try, to experiment, and most importantly, to express themselves.

In the process of research is the development of cognitive activity and curiosity, enriching the memory of the child, activate its mental processes, because there is a constant need to perform operations of analysis and synthesis, comparison and classification, generalization. The need to formulate patterns and draw conclusions stimulates the development of speech. The child's accumulation of mental skills, develop fine arts. It has to measure, count, compare.

The main advantage of the experimentation method is that it gives children a real understanding of the different sides of the object under study, its relationship with other objects, and the environment. Knowledge of the world is an active and challenging activity. The environment attracts the child with its novelty desire to know the unknown. The objects that surround the little ones are a source of curiosity for them and the first step of knowing the world. Young children's science content knowledge is of particular importance for comprehending more advanced scientific concepts and facilitating scientific thinking skills (Plummer, Krajcik, 2010, p.768) and is consistently associated with continued interest in science careers (Carneiro, Meghir, Parey, 2013, p.130).

Preschoolers like to experiment. This is due to the fact that they are inherently visual and visual thinking, and experimentation, like no other method, corresponds to age-specific features. Experimentation is a leading activity for



young children. For example, educators and parents should consider puddles as a "source" of cognition: and not be afraid that children will get wet or get wet.

In the process of experimenting, preschoolers learn to set a goal, solve problems and test them empirically, draw conclusions. They feel great joy, wonder and even admiration for their small and big "discoveries", which cause children to feel satisfied with their work. Given that preschool age, children are capable of learning scientific concepts; national and state learning standards highlight preschool science as a key area for learning and outline the specific science content areas that young children are expected to master (Ying Guo, Shayne B. Piasta & Ryan P. Bowles, 2015, p.140).

In the process of experimentation, the preschooler gets the opportunity to satisfy its peculiar curiosity (Why? Why? How? What if ...?), Feel like a scientist, researcher, and discoverer. The purpose of search-experimental activity of preschool children: the development of cognitive interests needs and abilities, independent search activity based on enriched and formed emotional-sensory experience.

Tasks:

- arouse interest in search activity;
- teach children to see and highlight the problem of the experiment;
- accept and set the goal of the experiment;
- choose tools and materials for independent activity;
- develop personal qualities: purposefulness, perseverance, determination;
- enrich the consciousness with meaningful information about the world.

In its activities, it should be based on the leading principles of development of preschoolers:

- the principle of psychological comfort: consists in the removal of stress factors;
- the principle of nature compliance: development in accordance with the nature of the child, his health, mental and physical constitution, his abilities and inclinations, individual characteristics, perception;
- the principle of differentiated approach: the tasks of effective psychological assistance to the pupils in the improvement of their personality are solved; it helps to create special pedagogical situations that help to reveal the psychophysical, personal abilities and capabilities of the pupils;
- principle of activity: involvement of the child in game, cognitive, search activities in order to stimulate active life position;
- the principle of creativity: maximum orientation on the creative beginning in game and productive activity of preschool children, gaining its own experience of creative activity;
- the principle of integration: the integrative nature of all processes that take place in the educational space (education and training, development and self-development, the natural and social sphere of the child, the child and adult subculture).

The impetus to start experimenting is often a wonder, a curiosity, a problem raised by someone or a request. Therefore, you should use all existing types of experiments in your work:

- random observations and experiments (do not require special training, are conducted offhand in the situation that occurred when the children saw something interesting);
- scheduled observations and experiments (pre-planned);
- experiments in response to children's questions (conducted in response to children's questions). The fact that children do not receive direct answers to the questions stimulates their intellectual development, inquisitiveness of mind and ability to find the answer by experiencing.

CONCLUSIONS AND PROSPECTS OF FURTHER RESEARCH

Based on the results, it can be concluded that in early childhood, the child is intuitively introduced to the world through sensation, perception. A variety of subjects attracts the attention of children of two years. Toddler examines objects in a variety of ways: twists, shakes, throws, and more. In most cases, this does not even require special equipment. Plants, animals, humans, objects of inanimate nature are being investigated.

The following points should be taken into account when experimenting with preschoolers:

- all proposed activities should be emotionally colored, arouse positive emotions in children and desire to act;
- for children of preschool age, the principle of repetition is relevant; so many activities can and should be returned in the process of work, even attributing them to the rank of traditional ones;
- at one time, you can consider one of the properties in its various combinations or one object with different properties.

The experiments with preschoolers allows the children to be acquainted with specific research methods, with different methods of measurement, with the rules of safety during the experiment. Children, first with the help of adults, and then independently go beyond the knowledge and skills acquired and specially organized activities, and create a new product – a building, a fairy tale, saturated with smells of the air, etc.

From the research that has been performed, it is possible to conclude that the experiment connects creative manifestations with the aesthetic development of the child. Particularly intellectually active, emotional attitude towards the environment, cultivated by the teacher, manifests itself in the desire to individually express in the process of experiment their personal experiences and ideas about objects and phenomena of the world. The criterion of the effectiveness of children's experimentation is not the quality of the result, but the characteristic of the process, which is objectified to intellectual activity, cognitive culture and value attitude to the real world.



In our future research, we intend to concentrate on the role of the educator in the experimental activities of preschoolers, the development of guidelines for teachers to acquaint preschoolers with the environment through experimental activities.

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