EDUCATIONAL RESOURCES OF LEGO® AS A MEANS OF LOGICAL AND MATHEMATICAL DEVELOPMENT OF PRESCHOOLERS

Olena O. Nikitina

Abstract. The article runs about the problem of formation children's readiness of pre-school age for studying mathematics at school. A special attention is paid on the leading type of activity of a child of pre-school age. The possibilities of using the game methods in formation of readiness for studying have been reviewed. The attention is focused on the educational technology with the use of LEGO® and LEGO DUPLO® resources.

Key words: child's readiness for studying, consecution, elementary mathematics understanding, mathematical development, game activity, game technologies, the system of «Lego Education» educational technologies, pre-school age.

The problem and its connection with important educational or practical tasks. One of the most important Elementary school requirements to mathematical readiness of pre-schoolers is their development of mathematical thinking. Getting a child into elementary mathematics is mostly impossible without sufficient development of logical thinking. The modern school is not

satisfied with the formal level of knowledge and skills of the pre-school institutions graduators. Further success depends on a quality of the acquired knowledge, its consciousness, flexibility and strength. That's why the pre-school didactic and method of formation of elementary mathematical knowledge as a science are directed on development of the ways of optimization of studying to increase the level of pre-mathematical preparation.

The modern social development and the level of technical means promotes the development and successful implementation in pedagogical practice of pre-school institutions and comprehensive schools the innovative game and constructive technologies, which are directed to increase the learning efficiency, develop and educate children by the way of making special developing environment.

The increasing of education quality by the way of variation of its content and methods is defined as one of the strategic task in the list of goals for the development of UN on the turn of the century. The latest UNESCO documents observe the educational pedagogical technologies as systematic method of formation and realization of the whole process of studying and assimilation of knowledge by students, taking into account the interaction of technical and human resources. An optimization of the educational process is realizing through respect to every child's life, providing his rights and freedom and also the development of his creative work through social and personally significant types of activity.

The analysis of publications (marking of unresolved problems). An intellectual readiness of a pre-schooler for studying at school as psychological and pedagogical problem has been described in works of L. S. Vuhotskyi, O. P. Usova, L. A. Venger,

N. M. Melnykova, F. O. Sokhina, T. V. Taruntaieva and others. The innovative approaches to the concept of competently oriented education are developing by O. Y. Savchenko, O. V. Ovcharuk, O. I. Lokshyna, S. F. Klepko, N. M. Bibik, O. I. Pometun, A. V. Khutorskyi, I. O. Zymnia and others. The problems of imagination and creative work have been investigated in works by L. S. Vuhotskui, Y. I. Ihnatieva, I. A. Bartashnikova. The game as leading type of the pre-schooler activity is reviewing in works by O. M. Leontiyev, D. B. Davydov, V. O. Sukhomlynskyi and others. The application of the educational technologies in studying of the pre-schoolers is considered in works by V. P. Bespalko, T. V. Luss, L. V. Ivashchenko, and others.

The purpose of writing this article is to study possibilities of modern game technologies concerning formation of readiness of pre-schoolers for mastering mathematical knowledge in Elementary school.

Presentation of the main work and argumentation of the research results. In a link of pre-school and elementary education the leading problem is studying and education of six-years-old children and providing sufficient, valid preparation for studying at school of the pre-schoolers. The children are taking over mathematics during specific lessons, which forms the basics of learning and counting. To make readiness for studying at school means to create initial conditions for successful curriculum and natural involvement into students' group. It is natural that the one of the most important feature of specific mathematical readiness can be students' particular knowledge, skills and experience. The main feature of pre-school and elementary education appears

in educator's counting the double side of the given process. On the one hand they have to admit an inherent worth of pre-school childhood relying on the leading type of activity – the game, from the other they should create condition for some elements of educational activity. An educator should develop mental skills in children in a process of discovering, based on their natural interest and curiosity. So in this way, a pre-school institution does an assignment of a comprehensive readiness of children to school in a process of systematic, purposeful pedagogical influence.

The researchers consider child's readiness for studying at school as a system which includes intellectual, willed, personalized, social and psychological parts. Some of them underline that a pre-schooler should have a high level of learning ability, which appears in ability to isolate educational task and change it in his own goal of a cognitive ability. It provides curiosity and observation, ability to wonder and find the way of revealed novelty [2; 3].

Personal, social and psychological readiness of a pre-schooler provides forming of readiness to accept a new social role of a schoolchild that expresses in a serious attitude to school, studying and a teacher.

The main elements such as willed actions – inner willed efforts have already been formed in a senior pre-school age, they are necessary to do a particular activity. A pre-schooler is able to make a goal to achieve it, to reveal efforts for overcoming obstacles, to value the result of his actions. This process is a direct reflection of an educational activity of a pre-schooler.

So we can depict such basic parts in psychological readiness of pre-school studying as:

– intellectual readiness: cognitive processes, sensomotor skills, capacity to learning ability;
– personal readiness: motivation, willpower, emotions, personal orientation, consciousness;
– social readiness: communicative and social competency [9].

According to a basic component of a pre-school education, educational line «A child's game» provides the development of creative skills, an independence, a self-starter, being organized in playing activity and formation of a stable interest for discovering the environment and realizing themselves in it. The game provides satisfaction from the game preference to every child, promotes friendly, partnership relations and game unities, induces exchange of thoughts, valuation of themselves and others, encourages to improvise, to express their own evaluative and ethnical judgments [1].

Among various types of games we should focus our attention on special ones that to our mind, promote formation of elementary mathematical idea the most. They are: constructive and building, didactic, table and printed. However the educational line «Constructive and building games» has determined such results of a pre-schooler development according to a basic component of pre-school education:
– ability to reveal interest and desire to display a wide circle of environmental objects, using previous experience of activity with different erector sets (including LEGO), using natural and artificial material;
– ability to observe systematically objects and constructors, separate the main parts of construction, their correlation in size, form, condition, plan, location;
– making their own work by model, condition, plan;

– ability to find an appropriate material, details;
– using various methods to build a construction and decoration element;
– ability to act successive, in coordination with other participants, to analyze the results of their own common work [6; 7].

The games which develop sensory perception have an important meaning to early mathematical development of a child, because such games provide happiness and interest, assurance in themselves and abilities. Playing actions with objects which develop not only fine motor skills, but perception, attention, memory, child's thinking and speech, spatial imagination.

Educators have a task to organize a place for game, to saturate it with the objects, toys which teach children to understand their characteristics such as size, form and color through the game.

Nowadays the most popular are educational technologies that use resources of LEGODACTA, LEGO® та LEGO DUPLO®. We think it's necessary to focus our attention on features and abilities of this educational technology in forming of elementary mathematical ideas of pre-schoolers.

The children of pre-school age found a base of their future character. Educational organization of pre-schoolers with the help of game allows them to obtain necessary life skills, to develop their creativity and curiosity through the whole life. A researcher T. V. Luss [4: 126–127] observes «LEGODACTA» as pedagogical technology that has its own aspects:

1. The philosophical aspect of technology «LEGODACTA» is based on a notion of «constructivism», which promotes an optimization of studying process by students' active inclusion of

knowledge. The children not only learn but create models of objects themselves that allows to get not only new knowledge about these objects but to understand connections and regularity that appear between them. As long as visually effective and practical methods are the leading methods of formation of elementary mathematical knowledge of pre-schoolers, these aspects allow to talk about «studying in practice» (Learning by making).

2. The conative aspect of «LEGODACTA» technology includes a specific notion of «hard fun». During the game with didactic information LEGO® the pre-schoolers are in condition which demands working and thinking for achieving a real result and satisfaction from their own intellectual activity. The value of a particular aspect appears in the way that the achievement of the desirable result discovers new possibilities, new perspectives and new motivation.

3. The social aspect of «LEGODACTA» technology consists mortgaged element of destroying in an erector set, which is natural for pre-schoolers and saves till seven years. A child can change, rebuild separate parts or the whole construction during the architectonic and actable activity with LEGO®.

4. The didactic aspect of «LEGODACTA» describes the technology as architectonic and actable method within free creative activity of a child and also as extra didactic method of a schoolmaster in a purposive pedagogical process.

The conception of learning in a system of educational technologies of «Lego Education» is based on a gradual structure «4C», which helps students to experiment and learn with getting new knowledge. The students are encouraged for cooperation, as if they work with the task of an open type.

There are several stages detached on the anvil with didactic textbooks LEGO®:

I. Connection: a theme or a task is putting in, this way allows students to ask descriptive questions and use available knowledge.

II. Construction: each task includes a constructive activity, which refers to testing the didactic material and creating objects, knowledge of which can be developed.

III. Contemplation: the students are discoursing of the things that have been learned and exchange their thoughts with each other.

IV. Continuation: each task ends with the new one, which is based on a previous, inspiring the students for learning something new and cognitive interest.

The actable technologies which use LEGO® and LEGO DUPLO® resources provide a formation of an effective educational experience in child which develops necessary skills such as: general colloquial, general descriptive, studying and organizational, examining and evaluative. The didactic information integrates the feeling of a child's joy of the game and possibility to fantasize by the way of using educational resources, which are intended for shaping particular educational results.

The LEGO® educational technology resources allow children of a pre-school age to learn with play and joy. The usage of these technologies certifies the formation of a child's commitment to study at school and implement an education through the game. The LEGO® educational method allows pre-schoolers to work and play together. In its turn, an organization of such type of studying forms social skills of a child's personality and motivates his imagination.

The pre-schoolers learn how to communicate with each other and solve problems together, because discovering the environment with children of the same age is much funnier. It gives opportunities to an educator to vary didactic basis for applying interactive forms of studying.

At the same time, the game obtains a sign of child's social and emotional development, improves informative and colloquial skills, which give basis for the further successful life in society. The resources for education for pre-schoolers can be used by several children at the same time. The didactic material and tool LEGO® was made on purpose to concentrate on particular spots of child's development. The main point of studying with the help of LEGO® method is based on children's fast achievement of successes – «right from the box» – from their studying and discovering activity.

In a process of elementary formation of the mathematical perception of the pre-schoolers the LEGO® educational technology resources help children to discover the world of digitals, shapes and colors, by solving educational problems through the game. To our point the most vivid examples of LEGO® technologies, which promote the development of the mathematical perception and skills of pre-schoolers can be:

1. Maths Train.

Educational textbook «Maths Train» changes pre-school mathematics in childish game with interesting mathematical tasks. In process of solving problematic tasks children extend the perception about plurality of positive integers, they can learn the body of number from two smaller, the children form the perception of positive integers, they learn to compare the number of objects with the figure and mark them with the

particular digital, they experiment with arithmetical activity of the first stage of adding and taking.

2. Creative LEGO® Brick Set for children of a middle and senior age motivates their natural interest. The set which consists of 1000 bricks allows children to create various lifelike or imaginary figures, objects or buildings. During the time they build, the children are developing fine motor skills, a spatial perception, a constructive thinking, a creative work. The child is absorbing perceptional sample as «form» and «size», learning how to plan his actions, the sense of concentration and desire to end the started job and desire to reach the positive aim develops.

3. Café.

The game set «Café» allows a child to become a chief cook in a worldwide restaurant. The set contains menu, receipts and article of food, which children compose from the bricks of different forms, sizes and colors. Playing, the pre-schoolers fasten perception of the basic mathematical notions: form, size, color and operate with objects' plurality, the basis of constructive thinking puts in, the spatial perception develops. The feature of the work with didactic material can be propaedeutics of an imagination formation about a half and a part. Children are discovering the form of the volume geometric bodies (for example: a sphere) during modeling a tomato, an ice-cream cornet and also thinking over the problem of other people.

Through the game children discover units of measurement of price, the meaning of price is forming. Children's work with receipts cards promotes algorithmization of thinking, because the cooking receipt is a serial algorithm [8].

In this way the LEGO® educational technology integrates some elements of game with experimenting, what activates thinking and colloquial activity of children.

The elder pre-schoolers tell about their building with pleasure, walk through the sequence of their actions, value this or that constructive situation. Working with LEGO® erector set provides some tasks to be done, which demand activisation of mental activity, for example, to finish a building with a particular feature (for example: «fill in space», «guess whose part am I?», «make alive your model» and so on).

Conclusions and perspectives. An intellectual readiness of a child of a pre-school age depends on a level of mental development. So, the main factor of children's readiness for studying at school is the level of their development of visually-shaped, verbal and logical thinking. The LEGO® educational technology offers educators modern methods of training of children for school with the help of which the pre-schoolers develop their word stock, communicative skills, improve their ability to summarize and make conclusions, develop mathematical thinking.

However, we should mention, that the methodical base of the given technology in the pre-school educational institutions of Ukraine demands some improvement, valid study and approbation. Successful realization of the educational skills of LEGO® depends on educational institution facilities, methodic background of the pedagogical staff and taking into account the requirements of the curriculum for teaching pre-schoolers mathematics. Further educational researches can be related to the study of the possibilities of using LEGO® technologies at the lessons of speech development, familiarization of the pre-

schoolers with the environment or at the lessons of artistic work. We should pay more attention to the methodic aspects of using of the given technology in studying of the pre-schoolers.

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Освітні ресурси LEGO® як засіб логічного та математичного розвитку дошкільників

У статті розглянуто проблему формування у дітей дошкільного віку елементарних математичних уявлень через застосування сучасних освітніх технологій. Проаналізовано зміст базового компонента дошкільної освіти та навчальних програм на предмет розвитку конструктивного мислення дітей дошкільного віку. Особливу увагу зосереджено на розвитку логічного мислення дошкільників через спеціально організовані дидактичні ігри із застосуванням освітніх ресурсів LEGO® та LEGO DUPLO®.

Ключові слова: готовність дитини до навчання, наступність, елементарні математичні уявлення, математичний розвиток, ігрова дівяльність, ігрові технології, система освітніх технологій «Lego Education», дошкільний вік.