UDC 37.032.5:004
DOI https://doi.org/10.52726/as.pedagogy/2021.3.2.8

O. B. POLEVIKOVA
Candidate of Pedagogical Sciences, Associate Professor,
Associate Professor at the Department of Theory and Methods of Preschool and Primary Education,
Kherson State University,
Kherson, Ukraine
E-mail: polevikov@list.ru
http://orcid.org/0000-0002-8144-1806

T. A. SHVETS
Candidate of Pedagogical Sciences,
Senior Lecturer at the Department of Theory and Methods of Preschool and Primary Education,
Kherson State University,
Kherson, Ukraine
E-mail: tattishvets@gmail.com
http://orcid.org/0000-0002-1234-0710

LEGO-CLASSES WITH PRESCHOOLERS AS A FIRST STEP OF ROBOTICS

The article considers the use of Lego design and robotics in classes with preschool children. The authors in their study proved that the development of design abilities activates the mental processes of the child, stimulates interest in creative problem solving, ingenuity and independence, initiative, self-realization, desire to find new and original, and therefore promotes giftedness.

The purpose of this study is to highlight new aspects in Lego preschool education through a variety of activities. The article analyzes the ways, methods and stages of Lego education with preschoolers.

Lego classes are aimed at the development of all educational areas of the child (intellectual, speech, creative, etc.). Speech development of a preschooler in Lego classes is aimed at the ability to analyze tasks and discuss the results of practical activities (description of product design, materials, story about the course of action and construction plan, construction of logically consistent statements in reasoning, justification, formulation of conclusions). They are also aimed at oral communication using special terminology; use interviews to obtain information and draw up a story; application of multimedia technologies for generating and presenting ideas.

The content of education is aimed at the development of the child's personality based on the values of social culture, providing mastery of behaviors, creative and active reproduction of communicative experience.

Organizational forms of social and personal development of preschool children in terms of organizing joint activities with adults and other children and independent free activity in accordance with the problem of the study: story-role play; creative games; pedagogical situations; conversation; storytelling; discussion of the situation; discussion of actions; common activity; collective work; exercises.

The content of psychological and pedagogical work is aimed at forming the physical culture of preschool children, health culture, primary values of health and healthy lifestyle in accordance with a holistic approach to human health as a unity of its physical, psychological and social well-being. The child is given the opportunity to hold and change position at will, to reach, take, hold and manipulate objects, move in space.

Key words: education, Lego design, preschoolers, robotics.

Introduction

Modern children live in an era of active informatization, computerization and robot building.

Technical achievements are increasingly penetrating into all spheres of human life and of course, they are interesting for kids. At the same time, the teacher should search for interesting and at the same time, simple ways to develop such children' qualities as curiosity, activity, autonomy, responsibility and parenting.

It is difficult to involve children to use abstract concepts, and the more impossible it is to force them to study material, if the purpose of this study is not understandable to them. Teachers tend to use a variety of methods, realizing that firstly they themselves need to learn modern technologies, because our students live in the world of computers, the Internet, electronics and automation. They want to see this in educational activities and to study, use, understand this. One of such modern

methods is the joint (preschoolers, teachers and parents) integration activities – Lego-design. Lego is a unique designer: it can be constructed from its parts as a tower, the height of which will be noted in the Guinness Book of Records, also as a robot that can measure ambient light and temperature, or sort items in the respective baskets.

One of the main issues in our knowledge of preschool learning that if the child's activity is creative, it makes her think and become attractive. This activity is associated with the creation of a new, the discovery of new knowledge, the discovery of new opportunities, and this is a strong and effective incentive to engage in the construction of Lego, the implementation of the necessary efforts to overcome the difficulties.

Lego are specially developed and designed in such way that the child in the process of an interesting game is able to get the most information about modern science and technology and master it. Some sets contain the simplest mechanisms for studying in practice the laws of physics, mathematics, computer science.

The theoretical backgrounds

The Lego Company has become the world's largest toy company [Davidson 2014] and it produced more than 60 billion bricks in 2014 alone. Lego products are sold in more than 140 countries, making it one of the most widely available toys in the world [Bartneck Min Ser Moltchanova Smithies 2016].

Genevieve Smith [Smith] has investigated that for children Legos means to build whole universes to their idiosyncratic specifications. For parents, Legos seem like the vegetable your kid actually requests and then eats in heaping mounds — a toy that's also a building block for future creativity, a mechanics lesson that doesn't feel like schoolwork, a wholesome embodiment of Scandinavian craftsmanship, something tactile in a world that is increasingly pixelated.

The extraordinary popularity of Lego is explained simply - this fun is suitable for people of all ages, the mind, inclining, temperament and interests. For those who like accuracy and calculation, there are detailed instructions, for creative people – unlimited possibilities for the creation (two simplest bricks Lego can be made in 24 different ways). For curious – the educational project Lego, for collectives – the possibility of joint construction [Borg 2014].

The way of development and improvement of each person is unique. The task of education in this case is to create an environment that facilitates the child's ability to reveal its own potential, will allow it to act freely, discovering this environment. The role of the teacher is to organize and equip the appropriate educational environment and encourage the child to become aware of the activities.

The course of studying the basics of robotics in a kindergarten is aimed at: assistance to children in individual development; motivation for knowledge and creativity; stimulation of creative activity; development of self-education abilities; attachment to universal values; organization of children in joint activities with a teacher [Casey Pezaris Bassi 2012].

Methods

The requirements for the Lego – design in our work was simple enough. We taught children to create structures based on the instructions. But even this allowed not only to develop the children' skills of designing, but also to solve other educational tasks. Using Lego, we asked children to realize simple, clear and attractive tasks for them, deciding which they learned and developed thoroughly [Clements Sarama 2012].

Purpose of the study: simulation of logical relations and objects of the real world for all age groups of preschool age.

Learning Objectives:

1. Cognitive task: development of cognitive interest of children of preschool age in robotics.

2. Educational task: the formation of skills and design skills, the acquisition of the first experience of solving design problems, familiarity with new types of constructors Lego WeDO 2.0, Lego Duplo.

3. Developmental task: development of creative activity, autonomy in making optimal solutions in different situations, development of attention, operational memory, imagination, thinking (logical, combinatorial, creative).

4. Educational task: education of responsibility, high culture, discipline, communicative abilities.

Expected results: formation of a stable interest in robotics and educational lines of the comprehensive program of kindergarten: cognitive, speech, artistic and aesthetic; social development; formation of the ability to work according to the proposed instructions; formation of the ability to creatively approach the solution of the problem; formation

of the ability to bring the solution to the readiness of the model; formation of the ability to express thoughts in a clear logical sequence, defend their point of view, analyze the situation and independently find answers to questions by logical reasoning; formation of ability to work on a project in a team, effectively assign responsibilities.

Forms of summing up the implementation of training: competition of kids structures based on kindergarten; joint project activity of children and parents; joint project activity of children and educators.

Technology. Designing.

Creation of active models. Reproduction of illustrations and models. Understanding that animals use different parts of their bodies. Demonstration of the ability to work with the schemes and different types of Lego.

Technology. Realization of the project.

Collection and research of models. Modify the model by modifying its design. Organization of brainstorming to find new solutions. Learning principles of working together and sharing ideas.

Math

Measurement of time, orientation in space. Evaluate and measure distances. Mastering the concept of an accidental event. Use of numbers and a numeric row to specify the duration of work. The use of numbers in measurements and in the evaluation of qualitative parameters.

The development of speech

Use of special terms in oral speech. Preparation and implementation of the demonstration (presentation) of the model. Use the interview to get information and make a story. Writing a script with dialogs. Description of the logical sequence of events, creating a statement with the main characters and its design with visual and sound effects. The use of multimedia technologies for generating and presenting ideas. Participation in group work as a "wise man", to which all the questions are addressed.

Stages of development by children of robotic activities

The first and second stages were preparatory.

1 stage of work on the study of the basics of robotics.

Age category: from 3 to 4 years old.

Different types of design are included in the rules of educational work of kindergarten. Along with the traditional wooden designer, the children performed buildings from the plastic designer, and also with enthusiasm engaged in the construction of paper of the origami type. In common activities with the educator, the kids mastered the standards of color, form, size, and developed fine motor skills.

At the age from 4 to 5 years, the children established skills for working with different types of designers. In this age, the prevailing form of work is the design by the plan. Kindergarten teachers created a subject-development environment in groups where children freely experimented with building material. Invented scenes, used models from the designer in the game.

2nd stage in the study of the basics of robotics.

Age category: from 5 to 6 years old.

"Designing using information and communication technologies".

In the educational activities of designing implemented exercises on the development of the robotics. Children not only fixed the acquired skills of designing bulky models, but also got acquainted with the unique possibilities of modeling buildings in this program.

Stage 3 on learning the basics of robotics.

Age category: from 6 to 7 years old.

"Design using robotics"

At this stage, cognitive and research activity of preschoolers prevailed.

Classes in designing, programming, research, as well as communication during the work contributed to the versatile development of pupils. The preschool children' development of robotic designing took place in 4 stages:

1. At the first stage of work, there was an acquaintance with the designer and instructions on the assembly, study of the technology of connection of parts.

2. At the second stage, the children learned to collect simple designs according to the models.

3. In the third stage, we were faced with the task of introducing children to the programming language and pictograms, as well as the rules of programming in the computer environment.

4. Stage of improvement of models proposed by developers, creation and programming of models with more complex behavior. Young designers explored how the model had an impact on the model's behavior: they replaced parts, tested, evaluated

its capabilities, created reports, held presentations, invented scenes, scripts and played performances, using their own models.

The development of the designer and its use was a managed process, not spontaneous. For these purposes, the obligatory element of educational activity was the presence of a clear strategy for using the designer in the educational process of the preschool educational institution [Clements Sarama 2012].

For an effective organization of classes with Lego design, we arranged an environment where classes were held with children. After the first lesson, educator understood the way of best work with Lego details - in a box or placement. The child moved freely and was not limited by the table's borders. In order to continue using Lego in class, it had to hold elements in its hands, try the variants of their fastening, get used to the brightness of these magic bricks, just play with them and start to freely navigate in the elements lying in the box.

In defining the forms and methods of organizing various types of children's activities, we took into account the features and interconnection of the game and the design. The training developed in the preschoolers the independence of thought, initiative, wit and ingenuity in solving constructive tasks that were formed through the needs of the game [Garner 2001].

Lego classes used the main types of design: by example, by model, by conditions, by the simplest drawing and schematic diagrams, by design, on the topic.

Basic forms and methods of Lego design: design, programming, creative research, presentation of their models, competitions between groups; verbal (conversation, story, briefing, explanation); visual (show, video review, work according to the instruction); practical (programming, modeling); reproductive method (perception and assimilation of the finished information);partial search (execution of variation tasks); research method; a method of stimulating and motivating activities (playing emotional situations, praise, encouragement.

Results and discussion

In our research, we invited 84 preschool teachers who were teaching kids with a use of Lego plays. At the beginning of the research, we made the analysis of the successfulness of using Lego plays for development of preschoolers' creativity. The results displayed in Table 1.

Table 1

The results of analyzing the successfulness of using Lego plays for development of preschoolers' creativity at the beginning of the research (in rates)

Lego plays	Early age	Younger age	Senior age
Constructing by model	12	23	41
Constructing under condition	21	52	65
Constructing on the simplest drawing and visual diagrams	4	12	41
Constructing by design	6	32	43
Constructing by topic	11	32	47

We asked preschool teachers to give answers for some questions about their work about the influence of Lego play on preschoolers' creativity. The results is displayed in Table 2.

Table 2

The results of teachers work with groups of preschoolers (in rates)

Have Lego plays the influence on the overall level of children' development?		
completely	partly	not at all
65	29	6
How often did your pupils look for their original way of realizing the purpose of design lessons?		
often	sometimes	never
64	32	4
Did Lego plays affect overall speech development?		
completely	partly	not at all
52	37	11
Have Lego plays contributed to the creative level of speech in children?		
completely	partly	not at all
68	24	8
How often did children achieve a creative solution to their tasks and tasks?		
often	sometimes	never
51	33	16

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 development of creativity of preschoolers with the use of Lego plays in their activities. However, such a positive dynamic is associated with

the use of various ways of constructing activity with Lego that are purposefully aimed at the development of preschoolers.

Lego is attractive because it can be picked up depending on the needs of the child at a certain age, and all the details are compatible with each other, which allows them to find application in new, non-standard models. Designers of this type are quite diverse, but, based on common features, they can be classified.

Innovative and multifunctional technology Lego not only provides the implementation of the main activities of children of preschool age – play and constructive, but also is a means of development of constructive activity of children.

The organization of the study of children involves the use of common actions by children in the development of different concepts. For this purpose, children are arranged in micro groups for 3–4 persons. Such organization stimulates active linguistic communication of children with peers.

Lessons with Lego mainly in speech development are aimed at the ability to analyze tasks and discuss the results of practical activities (description of the design of the product, materials, a story about the course of action and the construction of a plan of activity, the construction of logically consistent statements in reasoning, justification, formulation of conclusions) [Cook 2011]. They are also aimed at oral communication with the use of special terminology; use interviews to get information and draw up a storytelling scheme; the application of multimedia technologies for generating and presenting ideas.

The content of psychological and pedagogical work is aimed at the formation of physical culture of preschool children, health culture, primary values of health and healthy lifestyles in accordance with a holistic approach to human health as a unity of its physical, psychological and social well-being. The child is provided with an opportunity to hold and change at his own desire a position, reach, take, hold and manipulate objects, move in space.

Conclusions and prospects for further research

The child is a natural designer, inventor and researcher. These tasks laid down by nature are especially realized and perfected in design, because the child has an unlimited opportunity to invent and create its own designs, curiosity, wit and creativity.

The child learns from the experience the design properties of the details, the possibility of their fastening, combining, design. At the same time, it works as a designer, knowing the laws of harmony and beauty.

Children, who are fascinated by design, are distinguished by rich fantasy and imagination, active desire for creative activity, the desire to experiment, invent. They have developed spatial, logical, mathematical, associative thinking, memory, namely, this is the basis of intellectual development and an indicator of the child's readiness for school.

Using the Lego manuals is a new type of learning with extremely effective methods for influencing the child's personality.

REFERENCES

1. Davidson J. Lego Is Now The Largest Toy Company In The World. *Time Inc*. 2014. [Online]. Available: http://time.com/money/3268065/lego-largest-toy-company-mattel/ (in English).

2. Bartneck C., Min Ser Q., Moltchanova E., Smithies J., Harrington E., Have LEGO Products Become More Violent? – 2016. [Online]. Available: https://doi.org/10.1371/journal.pone.0155401 (in English).

3. Smith G., Lego Is the Perfect Toy even if no one can really agree on what kind of toy it is anymore. 2016, December 1. [Online]. Available: https://www.thecut.com/2016/12/lego-is-the-perfect-toy.html(in English).

4. Borg, S., Teacher cognition in language teaching: A review of research on what language teachers think, know, believe, and do. *Language Teaching*. 36. pp. 81-109. 2003. (in English).

5. Casey, B. M., Pezaris, E. E., & Bassi, J., Adolescent boys' and girls' block constructions differ in structural balance: A block-building characteristic related to math achievement. Learning and Individual Differences, 22(1), pp. 25–36. 2012. (in English).

6. Clements, D. H., & Sarama, J., Mathematics learning, assessment and curriculum. In R. C. Pianta (Ed.), Handbook of early childhood education. pp. 217–239. New York, NY: Guilford Press.2012. (in English).

7. Garner, B., *Legal writing in plain English exercises.* 2001. [Online]. Available: http://press-pubs.uchicago.edu/garner/. (in English).

8. Cook, C., Goodman, N. D., & Schultz, L. E., Where science starts: Spontaneous experiments in preschoolers' exploratory play. Cognition, 120, pp. 341–349. 2011. (in English).

О. Б. ПОЛЄВІКОВА
кандидат педагогічних наук, доцент,
доцент кафедри теорії та методики дошкільної та початкової освіти,
Херсонський державний університет,
м. Херсон, Україна
Електронна пошта: polevikov@list.ru
http://orcid.org/0000-0002-8144-1806

Т. А. ШВЕЦЬ
кандидат педагогічних наук,
старший викладач кафедри теорії та методики дошкільної та початкової освіти,
Херсонський державний університет,
м. Херсон, Україна
Електронна пошта: tattishvets@gmail.com
http://orcid.org/0000-0002-1234-0710

LEGO-ОСВІТА ДОШКІЛЬНИКІВ ЯК ПРОПЕДЕВТИКА РОБОТОТЕХНІКИ

У статті здійснено аналіз проблем використання lego-конструювання та робототехніки на заняттях з дітьми дошкільного віку. Автори доводять, що розвиток здібностей до конструювання активізує психічні процеси дитини, спонукає інтерес до творчого вирішення поставлених завдань, винахідливість та самостійність, ініціативність, самореалізацію, бажання втілити нові й оригінальні ідеї, а отже, сприяє розвитку обдарованості здобувача дошкільної освіти.

Метою цього дослідження є висвітлення нових аспектів Lego-освіти дошкільників у різних видах діяльності. У статті здійснено аналіз етапів, методів, прийомів Lego-освіти дітей дошкільного віку в контексті пропедевтичної роботи з робототехніки.

Заняття з Lego спрямовані на розвиток усіх освітніх сфер дитини (інтелектуальна, мовленнєва, творча тощо). Мовленнєвий розвиток дошкільника на lego-заняттях формує здатність аналізувати завдання та обговорювати результати практичної діяльності (опис дизайну виробу, матеріалів, розповідь про хід дії та побудову плану діяльності, побудова логічних послідовних висловлювань у міркуваннях, обґрунтуванні, формулюванні висновків). Вони також спрямовані на усне спілкування із застосуванням спеціальної термінології; використання інтерв'ю для отримання інформації та складання схеми розповіді; застосування мультимедійних технологій для генерування та презентації ідей.

Зміст психолого-педагогічної роботи сприяє розвитку особистості дитини на основі цінностей соціальної культури, що забезпечують оволодіння способами поведінки, творчим та активним відтворенням комунікативного досвіду.

Організаційні форми соціального та особистісного розвитку дітей дошкільного віку в умовах організації спільної діяльності з дорослими та іншими дітьми та самостійної вільної діяльності обрано відповідно до проблеми дослідження: сюжетно-рольова гра; творчі ігри; педагогічні ситуації; бесіда; розповідання історій; обговорення ситуації; обговорення дій; спільна діяльність; колективна робота; вправи.

Методи, прийоми роботи з Lego також сприяють формуванню фізичної культури дітей дошкільного віку, культури здоров'я, первинних цінностей здоров'я та здорового способу життя відповідно до цілісного підходу до здоров'я людини як єдності її фізичного, психологічного та соціального благополуччя.

Ключові слова: освіта, Lego-конструювання, дошкільники, робототехніка.