Helen Brezhneva
Doctor of Pedagogical Sciences, Professor, Head of the Chair of Preschool Education Mariupol State University Mariupol, Ukraine, ORCID ID 0000-0003-4387-4851, helen.brzhnv@gmail.com

THEORETICAL AND METHODICAL ASPECTS OF COMPUTER TECHNOGIES USAGE DURING MATHEMATICAL PREPARETION OF SENIOR PRESCHOOLERS

Abstract. *The problems in the use of computer technologies in work with pre-school children are analyzed in the article. The harmful consequences of unwary interest in computer and internet surfing based on actual and scientific facts are grounded in this paper. The author proposes her own views on the place and role of information computer technologies in work with pre-school children. Described in this article, the author sets out the logic of their introduction in the process of teaching children the solving of arithmetic tasks plus additionally, the role of mathematic computer games and presentations for the development of visual and creative thinking (both visual and active).*
Key words: *information and communication technologies; computer games; logical mathematical development; arithmetic task; mathematical operations; modeling.*

Relevance of research. One of important problems of teaching children mathematics – to develop interest to the mathematics. To encourage a child to "mathematics – logic" subject field in a playful, interesting way really helps to acquire logical and mathematical a concepts of elementary school. At preschool age children acquire rather wide range of knowledge about a set, number, form, size, space and time. This fact is confirmed by the basic component of preschool education [1]: logical and mathematical component defined in "The Child in Sensorical and Informative Space" educational line.

The maintenance of this line provides formation of representations, standards available to the child of preschool age, the properties and relation of objects and subjects of the world around, ways of mastering knowledge of reality, development of visual and creative thinking, verbally logical thinking. So, sensical and cognitive educational line is directed to integration of educational activity content, formation children's search and research, logical and mathematical competences, creation of an initial world outlook [1, c.22-23].

In our opinion, the solving of these important tasks it is possible under conditions of creation an active sensorical and informative environment thanks to optimum pedagogical technologies, in particular ICT which will provide independent intelligent and cognitive activity of a child. Nowadays computer technologies develop so fast that rapid transition from impalpable Internet virtualities to the Internet subject space when the person without a "mouse", just through the touch plunges into virtual reality. Thus there are some questions connected with determination of content and level of knowledge that could be mastered by preschoolers during process of study using computer communication, development and study of techniques corresponded to features of psychophysiological development of 3-6 years old children. Despite our attitude to information and communication technologies, it is necessary to recognize that the computer becomes a seine a component of modern environment, ICT get into all fields of the person's activity, and preschool education is not an exception. Obviously, timely solving of the ICT using problem in the course of formation of steady interest to mathematical knowledge become necessary, the ability and desire to use this knowledge, also to master and to improve them.

Formulating the goals of the article. In view of the above the purpose of article is: specification of the place and a role a computer technologies in logical and mathematical development of preschool age children; the reasons analysis of negative and positiv impact of ICT on children's mentality; the results analysis of local research on definition and justification of ways to applicate computer technologies in the course of teaching children in computational actions using the examples arithmetic tasks solving.

Analysis of recent research and publications. The problem of creation children's media space is

multidimensional, ambiguous, is also characterized by existence of the different points of view, sometimes diametrically opposed. On the one hand, modern problem of using computer technologies in teaching and education of preschool age children gets the increasing level. Therefore certain scientists and teachers support active introduction of computer technologies in work of preschool educational institutions. On the other hand, there are researches which prove negative consequences, connected with overexposure to information technologies. Domestic and foreign scientists (T. Vynograd, M. Castells, D. Harris, D. Feldshtein, F. Flores and others) prove that the Internet involves children, teenagers, youth more and more. Every day from 46% to 93% of teenagers spend time in the Internet. In fact they communicate, exchange information in virtual space. Significant changes in development of the child, his mentality, world outlook are consequences of such trend [17]. Confirmation of these facts is pilot reseaches are conducted by psychologists and teachers of latest decades in the different countries. So, D. Feldshtein specifies that all information space influence a lot on a child's mentality, that leads to emergence of stressful situations, and the increasing need for receiving finished product leads to failures in creative development of a child [17].

English psychologists proved that children who play computer more than 4 hours a day would have more likely problems with focusing on occupations or at a lesson. The infantilism of such children is also noted. Some information things teenagers place in their blog only to concentrate the attention on themselves. It reminds behavior of the child of early age which says: "Mother, look how I am jumping on one leg", or "look, I have put on my boots". It is natural to the small child, he constantly requires attention and receives confirmation of the existence in a such way. In comparison, for the adult which undergoes process of normal social adaptation similar the behavior is not normal. Scientists also note significant changes in structure of children's thinking.

Their thinking is full of complexes of images, texts and signs and is characterized as "clip thinking". The world around them turns into a mosaic panel shattered, disconnected facts. The child cannot concentrate on any information for a long time, his the ability to the analysis is reduced (E. Vechtomov, K. Koyama, O. Toffler, J. Naisbitt, D. Feldshtein, O. Friedmann and others). Therefore, overexposure to the computer leads to negative consequences. At the same time it is impossible to avoid influence of information technologies on a modern child. We live in wide information space now. The computer entered the life of a modern person strongly and forever, from 70th years of the XX century. The computer was used in work with preschool children for the first time in the USA at the Massachusetts technological university (1971). In the PostSoviet states territory informatization of preschool education began in the middle of the 80th years of the XX century. The first stage of researches was connected with development of scientific approaches to use a computer as one of means preschool didactics (S. Novosolova, L. Paramonova, Y. Pashelyte, G. Petku).

It was recognized that informatization of preschool education has to happen gradually: from the leading types of children's activity to informatics. That is the Informatics has to enter activity of the child through a game, designing, informative, artly esthetic activity and others [12, c.73-76; 14; 15]. Considerable experience of teaching children it is remained in the USA, Great Britain, France. In these countries there is a number of models of teaching children both at home, and school using a computer. Reseaches demonstrate that children who visit groups with computer training make greater progress in comparison with those who did not use the computer. Scientists note that the greatest interest is observed among children when they achieve the best results in a computer game activity. According to Yu. Horvyts in the course of children's activity with a computer three types of motivation were revealed: interest to the new subject – a computer; research motive (desire to find answers to unfamiliar questions); motive to successful solving of informative task [13].

All of this provide increasing level of child's informative activity and as a result - increasing level of personality development in general. The researches we analysed are conducted generally on teenagers and children of younger school

age.The results of these researches make us, scientists and practicians in preschool education field, review one of the important problems of the modernity from the new point of view: understand it for the proved, weighed, dosed usage of computer technologies in the work with children of preschool age.

Research results. We would like to consider this problem according to the logical and mathematical development of children. Modern content of mathematical education is directed, mainly, to intellectual development of children of preschool age, to the formation of culture and thinking independence. This problem aspect is the main one in development of the child. An adequate development of intellectual, cogitative activity relieves psychological tension of the child during the study, prevents uncertainty, keeps the health.

The integrated influence of various analyzers simultaneously on the child's identity is an important factor in development of cogitative operations, including computing operations. That is how preschool children perceive multimedia movies, computer games, etc. In this context the question of teaching children computing actions through solving simple arithmetic tasks becomes an important problem. The questions concerning a technique of teaching children, understanding the sense of arithmetic actions by children, the choice of ways to solve tasks were investigated by teachers, psychologists (H. Beloshysta, R. Berezina, N. Vapnyar, H. Kostiuk, H. Leushyna, M. Moro, N. Nepomnyashcha, A Pyshkalo, K. Tarkhanova and others). Scientists allocated the main structural components of arithmetic task (H. Beloshysta, R. Berezina, K. Tarkhanova and others), classified tasks by ways to solve and types of the used presentation (A. Stolyar, R. Berezina, R. Nepomniashcha and others). The essence of arithmetic tasks was specified. So, A. Stolyar notes that «to solve a task - means to perform the arithmetic operations determined by a condition and to meet the demans of a task» [18, p. 190].

According to this definition in favour of full work on a task the senior preschool child should have certain abilities: 1) to understand structure of a task and linkages between its data; 2) to compare and distinguish a task from the narration, riddles, proverb and so forth; 3) to be able to choose and perform arithmetic operations in a right way [2; 3; 6]. So, the mathematical task – is a laconic, logical story where there are given some values and it is offered to find other unknown values, dependent on data and connected with them by certain ratios, specified in a condition. There are all bases to believe that it somehow explains rather high interest of children to solving arithmetic tasks. However, in spite of the fact that computing activity arouse the interest, and the problem has its own role in the program of teaching in a kindergarten, the senior preschool children face with some difficulties in solving of arithmetic tasks. According to survey and testing of of the senior preschool age children, about 20% of children experience difficulties in the choice of arithmetic action, its argumentation. Solving arithmetic tasks, such children generally follow external, insignificant relations between numerical data in a tasks conditions, also between a conditions and a question of a task. It is shown, first of all, in misunderstanding of the generalized maintenance of the concepts "condition", "questions", "action", in inability to choose correctly the necessary sign (-, =).

During formulation of arithmetic action children do not use mathematical terms ("plus", "minus", "equal"), and common words ("add", "remained", "became", "will be"). Moreover, sometimes tutors focus children on these pseudo mathematical "links". In such situations computing activity is formed insufficiently consciously. It is possible to consider correct when children use common lexicon for designation of arithmetic actions at the initial stage of training (A. Stolyar, R. Berezina and others).

At the same time the tutor has to use mathematical terminology in own speech [18, c.193-194]. Obviously, the main reason for the low level of knowledge is in differences between computing and calculating activity. During a counting the child deals with concrete sets (objects, sounds, movements). He not only sees, but also feels these plural, has an opportunity to practice with them (to impose, put, compare, rearrange, combine, disconnect, etc.). In its turn, computing activity connected with numbers. And numbers are abstract concepts. Besides,

computing activity relies on various arithmetic actions which are also generalized, distracted operations with sets. Considering the features above , it is necessary to provide to the child an understanding of the essence of a simple arithmetic task. This process demands the analysis of its contents, allocation of its numerical data, understanding of the relations between them and, of course, specific actions which the child has to execute. Understanding of a task's question. which takes mathematical essence of actions away, is difficult especially for the senior preschoolers. In the course of our experimental work it was established that process of formation of computing activity has to take place accurately, systemically and step by step. Developing own approach to realization of problems of computing activity we analysed experience of practising teachers. The traditional system of teaching is based on acquaintance of children with arithmetic actions and methods of calculation on the basis of simple tasks where children's actions are reflected.

Such tasks help children to understand, for example, sense of finding of the sum of two composed. It is necessary to understand that solving a task, the child has to rise from simple distinction of quantity of surrounding objects and phenomena to understanding of the difficult quantitative relations between them (K. Tarkhanova). Accorfing to the conducted research, children do not realize the structure of a task at once, too. After understanding of task structure that differs from stories and riddles they have to comprehend the relations between numerical data. Formulation of a question to the task pose a challenge to the children.

The question containes two sides: 1) social and living; 2) arithmetic. Usually senior preschool children do not differentiate them and perceive a question to a task as the personal address to themselves. It happens because the child got used that when he is asked, it is necessary to answer questions, but not to repeat it. Therefore, repeating a task, children, as a rule, do not reproduce a question, and at once hurry to give the answer to a question. Tthey do not know the other function of a question yet. In such situation we need such formulation of a question for the child that creates a task, becomes obvious and inseparable. Gradually children reach to understanding that the question directs the attention to the relations between numerical data and understanding of things needed to be learned in a task. Researches of L. Kliuieva, R. Nepomniashcha, K. Tarkhanova and others prove the importance of understanding by children of concrete sense of arithmetic action of addition (subtraction), relations between components and result of these actions. Ability to allocate in a tasks known and unknown, and in this regard to choose right arithmetic action; to understand relations between addition and subtraction actions.

Meanwhile we established that the senior preschool children who study according to the standard technique of solving simple arithmetic tasks have not necessary level of knowledge about arithmetic actions, like addition and subtraction (58% of examined children). It happens because they understand relation between practical actions on the basis of association of arithmetic action with life action. They still do not realize mathematical relations between components and result of an actions because they did not learn to analyze a task, allocating known and unknown there. Even when children formulate arithmetic action, it becomes clear that they mechanically acquired the scheme of a formulation of action, without getting its essence, in other words did not realize the relations between components of arithmetic action as unities of the whole and its parts relations. Therefore they solve a task in the usual way - just counting, without carefull considering the relations between components. Those children who practised previously with various operations over sets (unification, allocation of the correct part of plural, addition, crossing) treat the tasks in a different way.

They understand the relation between a part and a whole, and therefore consciously make a choice of arithmetic action at the tasks solving. Experimental work on teaching children to solve arithmetic tasks prove the efficiency and expediency of traditional use of dramatisation tasks at the initial stage. It is necessary to acquaint children from parts of a task, its contents, using toys to help children to perform practical operations because the solution of such tasks based on the eye-mindedness thinking. After

several similar lessons it is logical to pass to the tasks of actions of children using media presentations where the geometrical figures and arithmetic signs are represented on the screen.

Children perceive visual information and at the same time learn to allocate components and to explain the actions. Such combination activates eyemindedness thinking mechanisms of senior preschool children, that affects positively on understanding quality and get into an essence of arithmetic tasks. Kids pass to illustrated tasks syep by step. If in dramatisation tasks everything is predetermined, in illustrated tasks the space for a changeable plot and imagination game is created.

The maintenance of a task and its condition can vary, reflecting knowledge of the world around. These tasks stimulate memory and ability to independently create a plot and consequently, bring to the solution of oral tasks. For the illustrated tasks are widely used interesting by a form and content various computer didactic games in combination with the multimedia presentations. Thanks to computer presentations the main requirements to illustrations are fulfilled easily – it is simplicity of a plot, dynamism of contents, well expressed quantitative relations between subjects. For example: there is an image of three planes on the screen. With these data it is possible to make onetwo options of the tasks. But illustrated tasks could be more dynamic. For example: green flower meadow, there are various objects projected on the background of the meadow. Thus, the subject is caused, but numerical data and the maintenance of a task can be varied to a certain extent (flowers, berries, insects, butterflies, etc.). When such interesting task is appropriate for the child, it has a positive, emotional flashback, that stimulates informative activity. The child interested in ultimate goal: to make, find the necessary amount of colors, birdies, geometrical figures, to turn them. Mental activity starts with eyemindedness information which captures the child.

At the same time children use two types of searching methods: practical (actions in rearrangement, selection) and intellectual (thinking about next step, predictions of result, an assumption of result). And after children have learned illustrated tasks, it is possible to pass to conditionally schematical modeling. In our opinion it, if not the main one, then seine method of teaching to solve the arithmetic tasks. For the senior preschool children modeling with real objects, things (designing) and graphic modeling (scheme, drawing) is optimum. The older a child, the more significant the second type of modeling became for he. The model helps to reveal sense of mathematical concepts which are given through the figurative explanetion (L. Kliuieva, R. Nepomniashcha, A. Funtikova and others). The model helps to acquire the generalized concept of arithmetic action (addition and subtraction) as the relation of a part and whole. There could be such sequence in work with models: I stage: the teacher and children create models together; II stage: senior preschool children develop it by temselves. Creating model, scheme children abstract from concrete signs of a subject and focus only on quantitative characteristics of a concrete informative situation. The model is visualized through media projector.

Children perceive conditionally schematic model on the screen, then solve the task. When the kids finished, they verified the results on their cards with the image on a slide. Teaching modeling takes enough time to form the ability to solve tasks, and multimedia technologies promote faster and full mastering of program material. The usage of the presentations duringorganized activity gives the chance not only to help children to master the material, but also to develop their interest in computing activity. Logical operations develop in the course of making tasks, children improve the ability to carry out the analysis and synthesis, to generalize and concretize, open the basic, to allocate the main thing in the text of a task and to reject insignificant. In this case the combination mechanism of figurative thinking and assimilation of abstract mathematical dependences works together.

All this thinggs significantly facilitates assimilation, understanding and memorization of mathematical material. In this way, our experimental investigations confirm, that the usage of systematicity and sequence of children inclusion in different action ways with evident and text material, and further application of modeling as a way and model, as teaching to solve arithmetic tasks in process directly organized

activity, promote not only to formation among preschoolers of concepts about quantity and number, but also development of such informative processes like memory, attention, perception, thinking. Besides, creates favorable conditions for the formation of such intellectual actions as abstraction, classification, analysis, synthesis. Modeling gives to children space for development of creativity, imagination. Its main objective - to provide children's mastering of a task structure, relations and proportion between numerical data.

Conclusions from the study and perspectives of further exploration in this direction. Computer games take a significant place in preschool pedagogics. Positive effect of computer games application is already confirmed with science and practice, they really develop cognitive interest, ability to concentrate children's attention, cultivate commitment of behavior, etc. Almost at every lesson the teacher has an opportunity to use media of the presentation, fragments of animated films (“Advices of Owl -the Aunt”, “The Wolf and the Seven Young Goats”, “The Three Little Pigs”, “Mashenka and three bears”), a computer games and exercises (“Guess a toy”,”Find an extra”, ”Yes-No”, “What could not happen in the world”, “Guess The Number”). At the same time the tacher should gollow the principles of the sequence, systemacity, dosage with a usage of computer games and presentations. Nowadays the issue of teaching children to solve the arithmetic tasks is relevant both in respect of preparing children to school, and of their mathematical development. Specially organized work on teaching children of senior preschool age the ability to solve such tasks is necessary for the general and mathematical development of children, it trains them to successful mastering of mathematics at school at the level of understanding of mathematical operations and actions. Computer games and programs are arranged so that in the course of playing the child learns to argue, make attempts, to check, make conclusions, to correct own actions, to experiment and work in the empirical way.

The important direction of researches in the area of computer technologies connected with involvement of the child to research activity. Therefore the further scientific investigations should be dedicated to to development of technological approaches to realization of children's experimenting with mathematical material.epts about quantity and number, but also development of such informative processes like memory, attention, perception, thinking. Besides, creates favorable conditions for the formation of such intellectual actions as abstraction, classification, analysis, synthesis. Modeling gives to children space for development of creativity, imagination. Its main objective - to provide children's mastering of a task structure, relations and proportion between numerical data.

References:

1. Basic component of preschool education (2012). A.M. Bogush (Scientific Ed.). Kyiv: Vydavnytstvo. 26 p. [in Ukrainian].

2. Beloshysta H. (2003). Acquaintance with arithmetic actions. Doshkolnoe vospytanye. 2003. 8. P.13. [in Russian].

3. Beloshysta H.V. (2016). The development of the mathematical thinking of a preschool and small school-age child in the process of education: monograph. Moscow Higher School of Economics: NYTs YNFRA-M. P. 63-79 [in Russian].

4. Brezhneva H. (2016). Mathematical Development of Preschool Children: from Informing to Understanding. Akulenko I., Bochko O., Bogatyrova I., Bosovskiy M., Bozhko A., Chernajeva S., Donets M., Golodiuk L., Tarasenkova N., & Volodko I., Conceptual framework for improving the mathematicaltrainin go youn gpeople: monograph. (p. 80–95). N. Tarasenkova, & L. Kyba (Eds.). Budapest : SCASPEE. 212 p.

5. Brezhneva H.G. (2017). Games of the logical and mathematical direction within the project "Shop". Metodychna skarbnychka vykhovatelia. 2. P. 39–42 [in Ukrainian].

6. Brezhneva H.G. (2018). Mathematical development of preschool: theory and technology: monograph. Melitopol: Vydavnychyi budynok Melitopolskoi miskoi drukarni. 481 p. [in Ukrainian].

7. Vaganova N. A. (2006). Understanding of the new information presented in verbal and visual forms by pre-school children. [text]: diss. for the sciences. degree dock ped Sciences: special 19.00.07. Institute of psychology of G.S. Kostiuk of

NPA of Ukraine. Kiev. 186 p. [in Ukrainian].

8. Vechtomov E. M. (2013). Mathematics philosophy: monograph. Kyrov: Yzdatelstvo: OOO Raduha-PRESS. 292 p. [in Russian].

9. Vinograd T. & Flores F. (2006). Language and intelligence. V. V. Petrov (Ed.). Understanding Computers and Learning. P. 185-229. Moscow Higher School of Economics: Prohress. [in Russian].

10. Voronina L. V. & Novoselova S. A. (2009). Innovative model of math education during preschool childhood. Pedahohycheskoe obrazovanye. 3. P. 25-37. [in Russian].

11. Castells M. (2016). Power of communication. Moscow: Higher School of Economics. 567 p. [in Russian].

12. Novoselova S.L., Petku H.P. & Pashelyte Y. (1989). New information technology in working with preschoolers. Is it applicable? Doshkolnoe vospytanye. 9. P.73-76 [in Russian].

13. New information technologies in preschool education. Yu. M.Horvyts (Ed.).Moscow: Lynka-Press. 328 p. [in Russian].

14. Novoselova S.L. & Petku H.P. (1997). Computer world of the preschool child. Moscow: New school. 128 p. [in Russian].

15. Novoselova S.L. & Paramonova L.A. (1998). Informatization of preschool level education in Russia: the beginning was laid in Moscow. Doshkolnoe vospytanye. 9. P. 65-71 [in Russian].

16. Rudenko I.V. (2013). Modern educational technologies in working with preschoolers. Science Vector of Togliatti State University. 2 (24). P. 423-426 [in Russian].

17. Feldshtein D.I. (2013). Childhood in the modern world (problems and research tasks). Russian Academy of Education, Moscow Psychological and Social University. Yzd-vo Moskovskoho psykholoho-sotsyalnoho un-ta ; Voronezh : MODЭK. 335 p. [in Russian].

18. Forming of elementary mathematical notions of preschoolers (1988). Stolyar A. A. (Eds.). Moscow: Prosveshchenie. 303 p. [in Russian].

19. Harris D.M. & Harris S.L. (2012). Digital Design and Computer Architecture. Elsevier. Morgan Kaufmann, 721 p. 2nd Edition.