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**THE DEVELOPMENT OF MATHEMATICAL CONCEPTS
IN RUSSIAN EARLY CHILDHOOD EDUCATION**

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Research on the problems of attainment of pre-school-aged children's mathematical concepts in Russia has undergone much reform.

The following scholars such as Y.A. Kamenski, J.H. Pestalozzi, E.I. Tikheeva, L.V. Glagoleva, F.N. Blekher, A.M. Leushina, A.P. Usova, A.A. Stolyar, L.S. Meltina, F.A. Mihailova and many others contributed greatly to development of theory and methods.

At the end of the 50-es and at the beginning of the 60-es of the 20th century A.M. Leushina developed the concepts of attainment of preschoolers' elementary mathematical concepts. Her idea was the basis of the preschool curriculum which was edited by M.A. Vasiliyeva. This program was single for a long period of time in our country.

The main goal of mathematical education is to prepare pre-school-aged children for the formation of elementary math concepts training begins at the age of 4.

The main form of training was a kind of lesson during which necessary mathematical skills were attained in a definite sequence. Such model of teaching gives an emphasis on the curriculum. A teacher used to show and explain a task by illustrating the pattern, finding out properties and connections of mathematical objects, while children listening to the teacher's explanation and answering questions.

Thus, preschool becomes similar with school overloaded with lessons on mathematics and other subjects while the dominant role of game and other preschool activities were ignored. As a result there were difficulties for children to education activities at elementary school. This program suggested such topics as "Quantities and Counting", "Dimensions", "Geometrical Shapes", "Directional Thinking", "Comprehension of Time". The names of these topics have become traditional in the system for formation of mathematical concepts in preschool. Nowadays in spite of changing topic content the names of these topics have remained in most modern programs.

Modern system of preschool mathematical teaching in Russia is based on the scientific viewpoints of outstanding researchers such as J. Piaget, L. S. Vygotsky, P. Y. Galperin, A. N. Leontiev, D. B. Yelkonin, A. V. Zaporozhets, L.A. Benger, N. N. Podiyakov and many others who enhanced significantly it.

The recent research has shown that the mind of a child is pliable and easily trained. It can be developed to a greater degree than it was previously thought. This fact gives new possibilities to enrich cognitive content of teaching program in preschool.

Modern researches outline preschool age is valuable because it allows children to fulfill different kinds of free activities.

A.M. Leushina's research outlines that children attain the concept of quantity at the age of 2. At this age children become interested in adding objects and operating with them. V.V. Danilova and A. M. Leushina assert that in the age of 2 children distinguish a right and a left hand. By the age of 3 children understand quantity with its limits? But they don't distinguish the components of this quantity. Accordingly, as E. I. Sherbakova considers, at the age of 3 children should be developed to understand quantity as a structural entity and each of component of the quantity. By the age of 3, according to experimental research of V. V. Danilova, children's comprehension of quantity develops significantly. Preschool-aged children establish links in notions and are capable to acquire some systems of knowledge (L.S. Vygotsky). In their research P.Y. Galperin and N. F. Talyzina show that preschool-age children attain abstract notions, acquire general mental activities due to well-organized teaching. The scientists come to conclusion that it is necessary to teach preschool-aged children logical actions connected with notions reflections and conclusion.

In addition V.V. Davydova and A.V. Zaporozhets underline, that preschool age maximizes the opportunities for personal development presented by each phase of childhood; because it allows children to fulfill different activities (playing, drawing, constructing). The variety of such kinds of activities gives children not only knowledge and skills. Also it develops their thinking, imagination and attention. Educational goals at preschool age are to be solved directly in such a way, because this approach is proved to help avoid problems in children's learning at school [7].

Social reforms in Russia have led to the necessity to have reforms in Russian education. In its turn it claimed to search new approaches to organize the preschool system. According to the new concept in Russian preschool education following requirements were added:

- to supply consistency in the process of attainment of preschool mathematical knowledge;
- to attain not only elementary math skills but basic math notions;
- to focus on mind development (to abstract, to sum up);
- to make favorable conditions to develop children's math skills;
- to develop cognitive process and abilities;
- to attain skills of educational activities at mathematical lessons.

For recent years preschool mathematical teaching content has been renewed. Teaching techniques and forms have also been improved. This renewal is closely connected with the action-centered paradigm in Russian education. This paradigm is characterized by a learner-centered approach, the idea of developing education. Russia's discipline-based approach to the pedagogical process of educating pre-schoolers is evolving into one that is customized to the individual child. (theories of L.S. Vygotsky, A.N. Leontev, D.B. Yelkonin, P.Y Galperin)

Accordingly the system of lifelong learning at preschool and elementary school has the following goals:

- to maximize the opportunities for personal development presented by each phase of childhood;
- to prepare the child for learning at the primary school level, not only in terms of his/her knowledge, but also in terms of his/her readiness to learn on a psychological level;
- to help the child master various approaches to interacting with his/her environment
- to allow for the development of an individualized approach to instruction based on each individual child's needs.

Thus system of developing mathematical education does not focus on the quantitative child's attainment of facts, ways of actions kept in memory. It focuses on attainment of and

development of own action with suggested math material. It is important for a child not to perceive formal symbolic information (numbers, quantities, math signs) as words and symbols for memorizing and reproducing. It is necessary that a child should consistently understand the meaning of information of mathematics, the meaning of its symbols. It is obligatory that a child should see and understand what arises out of here, he should obtain experience how to cope with a suggested situation, how to analyses change and study this situation. Only in this case a child will obtain attained conscious motivation of research (cognitive) activity. This motivation is the basis of attained conscious educational activity of a preschooler in future[1].

Mastering the new content of preschool math teaching techniques allows to carry out new demands: effectively and comfortably to teach children of different levels of development and of different rate of learning.

Vygotsky and Elkonin psychological scale of age founded (gives rise to) pedagogical scale which is considered to be a component of the structure of educational settings in Russia consisting of infant school (or nursery), preschool and school. According to this scale in Russian preschool setting there are the following age groups.

Group	Age
Very Young	2-3 year-olds, 3-4 year-olds
Young	4-5 year-olds
Older	5-6 year-olds
School-aged	6-7 year-olds

According to new concept many new curricula are elaborated in Russia which keeps content current: complex curricula encompassing all areas of educational development, and special or partial curricula for one or several areas of educational development.

An array of approaches to early childhood education is the key to keeping content current and reflective of evolving theories about the best way to educate young children in

the Russian Federation. Among essential modern complex curricula I would like to outline «The program of up-bringing and learning at preschool» edited by M. A. Vasilyeva, V. V. Gerbova, T. S. Komarova. In 2005 it was changed according to new achievements of modern theory and methods of Russian preschool education.

According to modern scientific, concepts of preschool education (the authors are V.V. Davydov and V. A. Petrovsky), which accept worth of preschool period of childhood, developing function of education is set forward. This function supplies achievement of (personhood and) child’s individuality and it reveals individual capacity. The elementary mathematical aim is to attain mental activity skills, creative and version thinking by attracting a child’s attention to quantitative relations of objects and phenomena in the surrounding world. The authors of the curriculum are based on L. S. Vygotsky research. L. S. Vygotsky considered that correctly organized teaching is followed by development, which is discussed to be the most important result of successive up-bringing and teaching children [2].

The curriculum is built on culture conformity which allows to take into account cultural values and traditions in education. It also supplies a shortage of moral education. Education is considered to be the process to attach a child to main components of human culture such as imagery, knowledge, moral, arts, labour and so on. The aim of this curriculum is to attain mental activity skills, creative and version thinking by attracting a child’s attention to quantitative relations of objects and phenomena in the surrounding world.

Elementary mathematics skills are developed according to accepted topics:

- Quantities and Counting
- Dimensions
- Geometrical Shapes
- Directional Thinking
- Comprehension of Time

Quantities and Counting	Dimensions	Geometrical Shapes	Directional Thinking	Comprehension of Time
A Curriculum for Very Young Children (2-3 years, 3-4 years)				
Pre-numerical period:	Comparison of objects by size:	Identification of cubes and	Recognition of the orientation	Determining the

Work with multiple objects (sorting and grouping)	larger-smaller, longer-shorter, higher-lower.	spheres, circles, squares, triangles, evaluation of their forms	of objects in relation to oneself: to-the-right, to-the-left, in front of, above-below, left and right hand	time of day: Morning, evening, day, night
A Curriculum for Young Children (4-5 years)				
Recognizing quantities and sequencing up-to 5, comparing two groups of objects using these skills	Comparison of two groups according to their length, width, height, placing up to 5 objects in order	Differentiation of spheres, cubes, cylinders, circles, squares, triangles and recognizing characteristics of shapes	Determining the locations of objects relative to oneself “near and far”	Identifying the order of different times of day, familiarity with “yesterday”, “today”, “tomorrow”, “fast-slow”
A Curriculum for Older Children (5-6 years)				
Numbers up to 10: Recognizing quantities and sequencing, comparison of proximal numbers, counting out, Composition of numbers up to 5, whole numbers and fractions.	Comparison of objects by size using non-standard units, approximating size by sight, measuring volume using non-standard units, putting objects in order.	Recognizing circles, ovals, rectangle in one’s environment. Familiarity with polygons, the grouping of shapes by various characteristics.	The orientation of objects in relation to other objects, movement in a given direction, following blueprints and diagrams	Familiarity with the days of the week and with the concept of the 24hr day, the development of a sense of time – awareness of time intervals.

The main methods of teaching children mathematics are practical, (illustrating) visual, descriptive (verbal, oral) and game methods. It should be taken into consideration that all these methods are used jointly in real educational process, but not separately.

Russian folk songs have a great potential to attain math elementary skills. For example

«Turnip»:



Who comes to pull the turnip out?

Who does grandmother follow?

What is she in succession?

Who is next to grandmother?

Who precedes zhutchka dog?

Who is the tallest in this fairy tale?

Who is the shortest?

How many people pull out the turnip in the fairy – tale?

Also other folk genres are actively used while teaching children math. To such folk genres belong funny poems (in Russian poteshki), poems, twisttingers, riddles, songs, songs and so on (video).

In Russia there exist many other alternative curricula. Among them I would like to outline «Rainbow» (edited by Doronova), «Childhood» (the authors are Loginov, Babaeva and others), «Development» (edited by Dyachenko).

All these curricula focus on:

- a leading role of social cultural aspect of development. It denies using schooling model of education at preschool (the idea of Zaporozhets about development amplification);
- creative peculiarity of a child's development;
- integral development of a child;
- development of abilities which is considered to be the most important (the concepts of Venger).

Certainly, each of these curricula has its own peculiarities. For example, in the curriculum «Childhood» other topics are presented instead of traditional: «Properties», «Relations», «Numbers and figures», «Invariability of a mound and quantity», «Algorithms».

Some curricula give a topic concerning development of logical thinking. The process of teaching is not always presented in the form of a traditional lesson and it may exist in different forms depending on children's age [6].

For example in curriculum «Childhood» the main forms of children's mathematical education are cognitive and developing games. Also there are widely spread such forms as independent work, mathematics competitions among children. These forms are successfully carried out by using modern techniques such as logical blocks by Dyeneshe colored counting sticks by Cuisiner and models.

The experience of teacher from the Child's Care Center № 3 under the name "Zolotnitchok" in Slavyansk-on-Kuban town is significant and great because they use modern teaching techniques in preschool mathematical education such as logical blocks by Dyeneshe colored counting sticks by Cuisiner. Play-lessons with sticks allows children to attain the skill to use different methods of action, to obtain sense experience, to develop a wish to understand counting, dimension and simple mathematical operations. The use of logical blocks provides developing logical thinking, combinatorics, analytical thinking. It also helps to attain skills necessary for solving logical tasks, gives concepts of algorithms, information coding, logical operations. Logical blocks by Dyeneshe develops a child's speech, because a child has to use such conjunctions as **and** ,**or**, the particle **not** in his speech.

In general the authors of these curricula consider that the main thing (essence) of a child's development consists of gradual entry to human culture by mastering various types of activities by developing ability to see the world and communicate with it by means of existing ways [6].

Within the general educational activity preschool settings may use specialized curricula. One of them is «The curriculum of preschoolers' math education in the system «School - 2000» (the author's Peterson edited by Dorofeeva)».

This curriculum is based on some didactic principles, among which the leading principles are:

- Psychological comfort level (forming a special subject – developing environment which will provide emotional comfortable condition to learn. To necessary condition of teaching children belong kind atmosphere and formations the situation of every child's success).
- Activity It means to obtain new knowledge not as a result, but as a child's own «discovery» of peculiarities and properties of studied objects and phenomena. It is done by means of own analysis, comparison, finding out main properties.

Thus, mathematics enters a child's life as a disclosure of natural connection and relations of surrounding world. The task of a teacher is to lead children to this disclosure by organizing and conducting their search activities. E.g. children are offered to roll two objects through the gate.

As a result of their own subject actions children (understand) discover that circle rolls because of its round shape without angles, Cube can't roll due to angles.

While putting pencils into glasses, they discover they may form pairs of pencils to compare them according to the amount:

- Integrated picture of the child's surroundings It means that every new view (vision) is formed in the interrelation with other object and phenomena;
- Creativity. A teacher should lead a child to attain creative skills. It means that children do not only study different math objects, but also they make up in mind images of the numbers, figures and geometric figures;

- Variability. A child has a right to make his own choice of actions. From the very first lessons children are offered systematically tasks with various variants of solving;
- Continuity provides succession on the content level, on the level of methods of math teaching at every educational stage. Preschool primary study (propaedeutics) is the basis for every following level of teaching and it allows children successfully to enter educational process in the 1st grade.

While playing children interact with adults and children cooperate with each other. They communicate in pairs and groups. Children shouldn't notice that they are in the process of a game – they freely go about the room, play with toys, balls, blocks of Lego. The system of learning organization should be accepted as a natural continuation of a child's play.

Mathematics should also be taught at integrated lessons. In accordance, spatial and time thinking should be connected with material concerning nature study. At drawing lessons it is useful to introduce the notion of **rhythm** concerning tracery, to find its rule and non-observance of its rules. Children may use the attained skills during walks in the open air. Teachers should provide many-leveled learning when a child may learn at his own pace.

The basis of the curriculum is the idea by Vygotsky about «the zone of the nearest development» of a child.

Within this curriculum teaching aids are used games (3 – 4). For individual work teachers may use different situations of putting on clothes going for a walk, getting ready for dinner. E.g. a teacher may ask a child how many buttons on his shirt, which of two scruffs is longer, what he has more pears or apples on the plate, where the right mitten is and where the left mitten is and so on.

Thus, mathematical block in this curriculum is presented more saturated than in other curricula. The author taking into account the principle of minimax enhanced math items with tasks to attain calculating skills and to develop notions of arithmetic actions.

Thus, preschool educational curricula in Russia demonstrate a wide choice of approaches to the aims of preschool education. They are based on different theories.

The first place belongs to curricula based on cultural historical and action-centered approach.

The comparative analysis of existing Russian curricula shows that many of them are based on well-developed Russian physiological pedagogical and methodological approaches. Altogether these curricula are to develop all main physiological properties of a preschool age, providing integral education of children.

But these curricula are considerably different in the forms and techniques of working with children. Among them there are curricula for gifted children. Many curricula insist on the necessity of collaboration with parents and give some forms of working.

Mathematical education in preschool in Russia is being developed, improved and enhanced due modern techniques, among which there:

- Methods of N.A. Zaitsev
- Methods of Maria Montessori
- Methods used for the early development of the Nikitin children
- Methods of Glen Doman
- Intellectual and creative technological play as developed by Voskobovich
- Methods for the development of elementary-level mathematical thought (A.V. Beloshistaya)

A.V. Beloshistaya considers, that mathematics helps to develop logical thinking. For example, 2-4 year-olds may be offered such a task: “Take the red ball”; “Take the red one, but not the ball”; “Take the ball, but not the red one”, “Take away all of the balls”; “Take away the round ones, but not the balls”, “Take away the small blue ball”; “Take away the big red ball”



5-6 year-olds may be offered: Find the shape that doesn't belong. Explain why it doesn't belong. Divide the remaining shapes into two groups. Explain why you divided them the way you did.



Take two triangles and combine them into one. Now take the two other triangles and combine them into yet another triangle, but one that is in a different form. How are they different? Is it possible to combine these two triangles into a rectangle? Is it possible to combine them to form a square?

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