

HOW PRESCHOOL CHILDREN LEARN MATH?

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Abstract

Modern understanding of elementary mathematics is based on modern understandings of psychological, primarily cognitive development of a young child, and also of the modern theories of learning and teaching. In recent years, especially rapid development marked psychological research on the development of cognitive functions and intelligence. However, there is still no set off attitude about what factors are decisive in mental, intellectual development of the individual.

Different interpretations of this problem mostly go in three directions as follows: first direction - according to which cognition overall knowledge reduced to external conditions, of the experience and audiovisual performances; the other direction emphasizes the importance of hereditary factor and inner maturation, so the role of education is reduced to practice what is established from the beginning and the third, which emphasizes the creative nature of man, with special emphasis on children's activities, which must be directed.

The findings about visual, acoustic and spatial sensitivity are particularly important for understanding spatial relationships, and characteristics of attention, memory, thought and speech of preschool children.

In this paper, using the method of theoretical analysis, descriptive method and based on participatory observation conducted in some kindergartens in Stip, R. Macedonia, we tried to find answers to several questions: How preschool children learn math? How child / student learn, experiences and adopt mathematical terms? Which and what strategies, methodological approaches applied educators? What needs to change?

Keywords: *strategies, preschool child, mathematical concepts, integrated learning*

"All those who intend to take up high positions in the city should be practiced in the science of numbers, not like ordinary people, but also to include their thoughts in the nature of numbers, not for buying and selling as it is dealing dealers and resellers, but to ourselves to ease the way towards a truth."

Socrates- Platoons dialogues

Introduction

The famous UNESCO recommendation "Mathematics and its style of thinking must become an integral part of the culture of modern man, regardless of whether he will perform actions that require math or not," points to the need for mathematics and mathematics education in the life of man.

In fact, the society development, civilization, in general, cannot be imagined without the emergence and development of mathematics. It lies at the basis of the technique and hence its determination as "the mother of the technique," and is one of the foundations of the natural sciences, but also an integral part of their structure.

Mathematics enters and in the field of social sciences. This is due primarily, to the tendency to what is happening in the natural, in the social environment, everything what you get as a

result of scientific research, to express, to present with precise values, quantitative, numerical values. To be able to use this knowledge, the child, pupil must be trained to acquire adequate mathematical culture and methodology adopted for their application.

In this context, the essential question is when to start to work on forming the initial concepts of mathematics or on which stage of psychological development is the child, which is allowed to work on the formation of early math concepts? How preschool child learn math and how learn child of primary school age? What strategies are applied by the tutor / teacher in the implementation of the initial content of mathematics education?

The answer to these and other closely related issues with them will be the subject of theoretical debate and research on this paper.

Meaning of mathematics and mathematics education

Meaning of mathematics education is multiple:

- Contributes to the development of logical-mathematical structures of thinking;
- Encourages cognitive motives in children, awakens curiosity;
- Contributes to the development of children's personality in terms ensures his attitude to work: diligence, self-initiative, conscientiousness, self- confidence, persistence, discipline, creativity etc.
- Contributes to the orderly socio-emotional development – admiration of task solving, the pride of success, cooperation, friendship;
- Allows the child / student to manage with their time and resources and act in everyday situations that involve people (example: calculating how much time we need to come to school, how much food is needed for our family, etc.)
- Contribute to problems solving and building important decisions;
- Allows the use of technology (example: calculators, computers) to solve problems;
- Enables pupils to detect the essence of mathematics to science and society, enables them to independently find the quantitative and spatial elements and their relationship to nature and society. Pupils need to gain a clear insight that mathematical creations are natural creations and not imposed from outside of nature;
- Orientation of math teaching to the needs of life, proper motivation and necessity of possessing mathematical knowledge, awakening and developing interest for mathematical phenomena;
- To enable pupils to understand numerically the environment. This means that mathematics enables pupils to perceived numerical relationships, their order and accuracy in appearance, also to implies a higher degree of intellectual development;
- Systematic development and improvement of mental functions at pupils - developing the ability of observing, fuller present and concept, the ability of post-analysis and synthesis, abstraction, induction and deductive thinking, thought- logical forms of conclusion;
- Development of functional thinking;
- Endeavor to find the easiest and quickest way that leads students to an understanding of rationality in the work, rationality needed in life in general;
- Clear and accurate speech, some choice words that accurately indicates the term;
- Persistence - the matter work that led to the end;
- A sense of accuracy, timeliness, transparency in the work (written and graphic works of pupils);
- Self-confidence, proper assessment of own forces;
- A sense of nice – directs students to detect the geometric creations of compliance;
- Improve practical knowledge (teach pupils to assessment by eye a different distances, how performed various measurements, how to use a ruler, compass and learn to construct geometric figures, etc.);

- Facilitates the understanding of all other sciences that use mathematical language and symbolism.

According to the above mentioned, we can conclude that mathematics and mathematical knowledge is the basis for the development of the child, the individual, the development of science and in general, development of society.

When to start to work on early math concepts?

Early access to pre-school education leaves their mark on the whole further education of each individual, of her building as a positive, creative and active person, person who wills belief in own self, respect for herself and others around her. Existing contemporary curricula of preschool education, kindergarten, help children to acquire basic knowledge, notions and concepts from all educational areas, to form the basic cultural and hygienic habits, enriching their experiences contribute to their socialization.

In this sense, preschool education is very important and has great significance and role in the formation on the basics and foundations of which are built: notions, concepts, knowledge, skills and habits, and on the development of creative abilities of children, create the basis for proper and comprehensive education and upbringing of children, the basics of a successful start in primary school.

For new and contemporary math that gets into every part of human life, whose pace of development and degree of application are running high, man has to be prepared since preschool. Namely, with the numerous mathematical terms the child meets from the earliest age. Do not be uncommon examples when the mother in daily communication with the child - infant 1-12 months, in feeding, dressing, playing, singing with the child, uses mathematical concepts. The process of formation of mathematical concepts even more intensified in the preschools, where through various activities especially activities of educational areas - math, and across different types of games, in an organized way run this process.

How the child from preschool learn math?

The child from their early age can recognition certain terms such as: number of years, fingers, feet, but these notions don't have expressed mathematical dimension. Exactly hence, the essence of mathematics education is expanding fund of concepts and relationships as well as training for their expression by mathematical symbols. Child / pupil should be put into situation to comprehend, understand mathematical concepts, not to reproduce and store. Bearing into consideration the abstractness of mathematical concepts, the efforts in contemporary mathematics education, is, first to go to learning mathematical concepts through the application of specific, concrete objects, and later adoption of abstract concepts; application an inductive approach - allowing the child / pupil not only to determine the conditions, but also to reveals some cause and effect relationships, to recognizes elements of the so-called mathematical causality, enables compliance with the principle of gradation, going from the concrete to the abstract; development of logical thinking, the way which allow to quality and permanent learning with understanding. Exactly hence, we put the question: how learn math child from preschool age?

In that hence, we ask how the child from preschool age learn math.

The notion of learning is different identified by different authors. We emphasize the determination from Kamenov (1987: 25-2)), according to whom learning is "consciously directed process of collecting, understanding and adoption of facts, conclusions, opinions, generalizations about objects and phenomena and the manner of treatment to them, processed, generalized and arranged in a system of knowledge. Learning implies the processing and shaping of experience, understanding, and discovery and pervades into the essence of phenomena, the restructuring of the already existing knowledge and establishes associations between knowledge. On that way the learning is a condition and way of acquisition and development of knowledge, skills, habits and skills necessary for the child's

life, including social relations, formal education and self-improvement", and the determination of Lazarevski J., (1980: 171) from whom "learning is progressive and relatively permanent change of an individual which arises under the influence of the environment and which is caused by the need of the individual that is changing."

Based on these and other goals of the learning can be concluded that learning is understood as a process that begins and ends not once and for all, but as a continuous, ongoing process, a process that is determined by the needs of the individual, a process that depends on numerous factors: environment, the activity of the individual, a process that leads to changing of the individual, his growth, maturation, maturation..

Regarding to the understanding of the learning process in contemporary professional literature vary several groups of learning theories such as: behavioral theory according to which learning comes through creating links between stimulus and responses, reaction, and by association, so any learning is learning in certain situations to react in a certain way. According to this theory in which learning leads to changes in individual behavior, is a huge role of the teacher in modifying the behavior of the pupils. He is the one who leads the pupils through organized, predefined learning activities, according to which set forth the specific reactions of pupils, reactions that are measurable.

Precisely on these theories was based the traditional concept of educational / teaching work in math. Namely, Barodi and Irvine (2000) point out that in the traditional approach to teaching mathematics based on behavioral theory denotes the application of reward or positive support when children learn mathematics. Attention is directed to the "consequences of behavior" rather than a true understanding of mathematical processes.

In learning math's nurture psychology in which the emphasis is on training sets the capacity and the ability to memorize and reproduce, leading to the creation of a situation of fear and hostility towards mathematics, "mathematics is bogeyman", "not everyone can grasp, and understand".

The second group of theories that explain the process of cognitive learning theories whose representative is Tollman, that "learning in its founding base contains relations that exist between stimuli and situations, and that it is a process of cognitive nature (Lazarevski, J., 1980: 202).

For child math education are particularly important constructivist theories of cognitive development and their implications. The same emphasis placed on the individual activity. According to them, the individual should be active in the learning process. One of the representatives of this theory Piaget believes that learning cannot be reduced only to the accumulation of knowledge in a particular subject.

Namely, according to the constructivist understanding knowledge represent a construction of one who acknowledges and is based on mental activity. Child previously created notional framework, and new learning must be included in this framework. Child / pupil actively participate in problem solving and critical thinking marked as learning activities in which child investigate relevant and pleasant. Child / pupil constructs their knowledge with testing ideas and approaches based on previous knowledge and experience and apply them in new situations, so he integrate new knowledge based on pre-built constructs.

In the process of teaching children / pupils will be allowed to come to their own answers rather than to tell them answers. Every child /pupils constructs meaning, the meaning of what is being taught. Particularly great importance in this process has interactivity; special meaning has two way communications. Vygotsky, Piaget especially emphasizes the importance of social interaction. Social interaction allows the child with an adult, to do something, in the area of next development, which cannot independently make in the area of current development. The child should be actively participating in the process of interaction

in an equal joint activity with an adult teacher. Activities should be challenging, and the teacher should help pupils if the need arises from this, that directs them.

Developing a positive attitude towards mathematics and confidence in their own performance are key components of children's learning and future achievement in this area. The learning environment can support and encourage positive attitudes, assumptions to promote critical thinking, strengthen mathematical skills and help children / pupils in building connections with their previous mathematical knowledge and the world around them.

Of particular importance is the theory of experiential learning which actualizes approach directed towards the child / pupil that not only understand not only from the previous experiences of the child / pupils but implies to take into account their needs, interests and abilities., An approach that involves learning with action (learning by doing), learning based on direct interaction with the phenomenon that is learned in real-life situations. According to representatives of experiential learning, learning is a holistic process that includes the integrated functioning of the whole person (not just some separate parts).

All these theories essentially advocate the use of so-called research approach. Research approach understands that children must experience mathematics, but mathematics that is understandable to them, arising from the reality of the context which for them makes sense. The tasks are chosen to be interesting, motivating for children, to promote the activity, to research.

Child / pupil better learn math through activities that allow him to play, describes, classifies, explains, analyze, synthesize, generalize, thinking about what is explained, to explain how he, or she, alone comes to solving tasks, set and solve problems, when he/she establishing contact between what are provided to learning, set rules about it and with their own prior experience. A very important part of learning math is learning how to solve problems. In this sense, before children are placed problem situations that stimulate their curiosity and research spirit, to use influence research, affect the development of their reasoning and the ability to learn how to go further in solving problems. They learn that there may be more than one way to solve the problem and more than one answer. Also learn how to express them clearly when explaining their solutions.

Therefore it is necessary, to the child, to form a positive attitude and positive emotional orientation toward mathematical concepts that are available for anyone who will show interest toward them.

Developing a positive attitude towards mathematics and confidence in their own performance are key components of children's learning and future achievement in this area. The learning environment can support and encourage positive attitudes, assumptions to promote critical thinking, strengthen mathematical skills and help children / students in building connections with their previous mathematical knowledge and the world around them. Developing and promoting of such work environment is a matter of the whole community.

Which and what strategies are necessary for learning math?

The idea of monitoring strategies applied in the initial mathematics education emerged from previous, frequent contact with teachers in child-care institutions and perceived differences (based on practical students work) that exist between them in terms of strategies applied in the process of forming the mathematical concepts. The objective of the research was to obtain qualitative information on the strategies applied by the subjective factors in the formation of early mathematical concepts

The selection of children's institution was intentional. It is a preschool institution Vera Ciri Viri Trena in Stip, R. Macedonia, oldest child institution in our community. Director and staff in children's institution showed from the outset, readiness for cooperation, assistance, openness, and collegiality.

During the research are create new hypotheses, generate new questions are repeated several stages in the research. During research were realized, numerous visits, were monitored many activities in which processed new content aimed at establishing the initial mathematical concepts. At the same time we observed strategies which were applied from both parties (educators / children) in the initial adoption of mathematical concepts, were observed relationships between members in classes, educational groups, conversations with educators, Director, representatives of professional services.

The monitoring strategies in the initial mathematics education were conducted in the form of descriptive and focused observation. Descriptive observation led to the data of the environment and working conditions under which work educators and children, and focused observation led us to the data for the specific strategies used in educational work in the initial mathematics education.

Given the impossibility of presenting all the data in a paper, limitations of the number of parties, we decided to present the selected presentation of the most typical data which allow for clear ideas about the strategies applied in the initial mathematics education.

The results of research

October 17, 2012

First day with the children of the great educational group. After the warm reception by the teacher and the warm welcome from the children who were familiar with my visit, planned activities began. That day in the educational math realized the activity "smaller, larger and equally." The children gathered around their tables by the request of the teacher and carefully listened and observed.

T: What according to you kids is the greatest? Let's know what your head think?

Stephen: The biggest is building.

D.D.: Many know, I saw large skyscrapers on television.

T: And according to you, what is the smallest in the house, at home? What is something great that surprise you, and what is the smallest?

Anna: The biggest one was when the truck when I traveled to Kicevo.

Stefan: And I saw on TV a hippo. And least I saw a black mouse.

T: Please Stefan would you describe it?

Stefan: It was small with a long thin tail.

T: And now I'll ask you something. I put on this table (three sets fruits pears, different in size) and please nice to look at. Now, Ivana, please take the big pear and gave him to the Dimitri.

T: Stephen, you take it and give smaller pear to Ivana. Dimitri you take the smallest pear and gave it to Stephen!

All this made the children without hesitation. As from early age to have accepted the terms smaller, bigger, biggest.

T: Now on the table I will put three cups. Please, one of you will come and should deploy in size, from largest to smallest.

D1: Properly set the glasses.

T: And now in this basket I will put some fruits and I will ask you to sort. Some of you will close your eyes, and you have to guess which fruit it is. Then children will ask you something else.

Children with closed eyes, touching them, recognized the fruits.

T: Now everyone, please, view the fruits that your buddies hold you in their arms and the size of the fruits to arrange ranging from the largest to the smallest fruit. Who first of their friends who hold hands in most fruit should stand?

D2: Successfully deployed the fruits of their friends who held in his hands. The activity ended with the game "hunting", looking for the greatest items in teaching room and sort them by size.

October 27, 2012

Today, in the words of the teacher, was to be successful and interesting for pupils

T: Today children, here we will play with dolls in our theater corner. Shout of joy and amazement from children. Each of them looked nice fit on the chair and find a better position from which to follow what happens in theater corner.

T: But before you ask something: Have you seen these shapes (points) here around you?

D: Well we play every day with them, ball and cube it. Such has in "angry man"

T: Well, now pupils, see what they did, what they discussed. Followed the presentation of the educator, booth the quarrel between the ball and the cube After the presentation, the teacher asked for their importance in their lives and the more you play.

Followed also reviewing and highlighting its characteristic.

Stephen: It is round, jump, has a beautiful red color.

D1: There are other colors and large and small for football, basketball.

U2: For volleyball, handball.

T: What about a cube? Let's take a look. What is this (points to the sides) and how many?

D: Number: One, two ... six sides.

T: Let's try to roll.

D: It have corners, only the ball rolling.

Further activities continue with the game "Magic Case" and "Train" - educator simulated sound of a train in which children were charged according to the image, subjects ball and cube, taken from the magic bag when the train passed them despite all. In the final part of the children were divided into two corners. In the first corner contrasted puzzles, and in the second played game in pairs "garage" - Ball and Cube, "Who is faster and why in the entrance to the garage?"

December 1, 2012

T: Today children I will tell you a captivating story. Yesterday I left here when I heard an unusual whisper. When I looked I saw a triangle, rectangle, square and circle as talk. They said: The children didn't want us. We are logic boards, the children not seen us, not talk with us.

T: And, I my child, taught today and I said, "I'll see if my children know the logic boards?" (Meanwhile teacher shows them in the logical tiles) Let's see if it does as you might think (it shows logical tiles) ? Children recognize and give answers.

Metalip: This is a triangle.

Angelka: This is a square.

Ivana: This is round.

Sanja: This is a rectangle.

T: Well, now kids and I was assured that you really know the logic boards in shape. But if the children know that they are different to each other and something else.

DG: We know that there are a variety of large and small, fat and thin, blue, yellow, red, saw in the box of my brother, he is second grade. I play at home with them.

T: Yes, children, and you really much you know. Now I will show you that they really are different in color, shape, size and thickness (showing application). Let's look at the triangle?

Stephen: The triangle is large, yellow and thin.

Mirko: red circle is small and thin.

Alexander: The rectangle is blue, big and thick.

T: Now I'll show you other pictures. Ivana, Come Go ahead and give you a picture. Diddy, will come and he has a photo. Vladimir, and you? Now your friend Ivana will show you, and you need to tell us what you see on the picture, and if you hit, Ivana will explain.

Vladimir: It is square, yellow, thick, big.

T: Stefan?

Stefan: It's a triangle is red.

Alexander: Small and thick it is.

Christina (also has a picture in his hands), and affect: Mirko-blue, Simon, slim, Martin-large triangle.

T: Now we will do something else. You play a game that is called "Something Missing?"

Show rectangle. Please now refer to you and asks you to tell me what are its features and what is missing.

D: It is rectangular, thin, and small and lacks color.

T: How can it be in color?

DG: select one of the colors (red, blue, yellow).

What followed was playing the game "this little step" through logical tiles. Children have a task to checked in the logic boards and determine their characteristic. If you guess you are going to the next step, if you do not step forward one step back to move forward.

The activities continued with the game 'miracle bag ', which are detected by the geometric forms and they affect children. Followed by a question asking whether the educator of logic tiles can make a set of glued on the magnetic board. Children responded affirmatively that was supported by the establishment of a set using Venov diagram. Then the teacher asked them, "Are all these logical tiles belong to the set, the answer yes, because they do not have a model that will show specifically that logically belong tiles, so not belong in the set. Then the teacher explained that actually need to mark the model. Educators also asked whether children from parts of the body can be formed logical forms, so they remind us of.

D: Head-round, hands, feet-thick, thin.

The children grew and personally presented them pointed shapes.

The next thing is the establishment of the sets of logic tiles under certain signs displayed on the models. Activities continued on. There was integration of content with art education with children geometric forms made of paper collage according to various signs.

Previous analysis strategies applied in the implementation of content aimed at establishing the initial mathematical terms, the dominant methods of operation, established communication and interaction between the subjective factors are reflected in the way of learning, experience and adoption of mathematical concepts.

The child / pupils are allowed to count, compare, and measure, analyze, synthesize, classify, explain, and solve problem tasks. The investigation approach allows the child / pupils to trace, using multiple sources, discover, collaborate, ask questions, let alone come to new insights.

In the process of adopting early mathematical concepts, constantly create conditions and opportunities which enable the child as an individual to become in direct contact and relationships with their classmates, teachers.

The application of the strategy of cooperative learning also provides opportunities for constant communication of multiple relationships, both within the existing group and outside of her. Everyone work with everyone, asks for help, help and cooperate

Teacher role.

Great is the role of the teacher / educator, who should be master of his craft, which will allow children active approach, gradually entering into the world of entertainment and interesting math. He is the one who has the role to enable the child to use the selected strategies, to use different approach to adopt new math concept.

What need to do, to be good, effective math teacher?

- To enable pupils to learn the most important mathematical concepts;
- To work effectively with different pupils;

- To finding numerous mathematical activities;
- To assess the knowledge of the pupils and on that base to build new;
- To evaluate and organize a different sources and materials that are available and needed by pupils;
- To support the communication of multiple relationships;
- To facilitate cooperative and individual work that will detect;
- Focus on building desire for togetherness, trust, sharing;
- Capacity for evaluation of children's mathematical thinking.

Conclusion

The analysis of the theoretical discussions of this problem and the empirical data that came up in the survey carry us to the following data:

- Previous questions, found their answer in theoretical debates as well as the data from the realized study;
- The conclusion of this research should not be accepted as categorical, because they relate to the specific sample in a certain time period. However, they still should be accepted in order to improve, enrich the strategies applied in the initial mathematics education.
 - The application of different methods of educational work in mathematics (demonstration, illustration, text method, ..) as well as different forms of educational work in mathematics (frontal, group, individual) positively affect the independent work of the child / pupils, their interest and motivation to work and the possibility of better communication and constant feed back
- Actively introduce mathematical concepts, methods, language, across a broad range of experience and some teaching strategies.
- Planning and implementation of activities that will stimulate research, independent work of the pupils;
- Supporting children's learning through constant evaluation of children's mathematical knowledge, skills and strategies.
- Provide an environment that supports and courageous learning mathematics - "every pupil can successfully learn mathematics depending on the instructive strategies and encouragement."

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