Pedagogical Cluster- Journal of Pedagogical Developments
PCJPD: Volume 2 Issue 4, April 2024, online: ISSN 2956-896X

PEDAGOGICAL CLUSTER
JOURNAL OF PEDAGOGICAL DEVELOPMENTS

Website: https://euroasianjournals.org/index.php/pc/index

Some features of the formation of mathematical representations in preschoolers in the process of familiarizing them with the size and shape of objects and the concepts of quantities and numbers

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Summary:

This article discusses some issues of the methodology for the formation of sizes and sizes of objects in preschoolers. Emphasizing that children learn the sizes of objects mainly in sensory ways in the process of examination, comparison and comparison, grouping, and the sizes - by measuring objects and using numbers for the purpose of quantitative assessment, the sequence of mastering the values at preschool age, ways of mastering preschool children measurement of quantities, as well as methodological requirements for teaching children five years of measurement activity. This article examines some of the methodological aspects of the formation of the concept of number and magnitude in preschoolers. Emphasizing that counting is a mathematical concept, this is an operation aimed at determining how many elements a given finite set contains, methodological features are given for the development of ideas about the natural series of numbers, a technique for the formation of the ability to group objects (2-6 years), the formation of ideas about the plurality and singularity of objects (from 3 to 5 years old), the formation of the ability to

highlight 1 and many objects in the environment (from 3 to 4 years old), as well as the method of teaching counting (4-6 years old). based on a comparison of two groups of objects in terms of quantity.

Abstract:

This article discusses the issues of methodological aspects of the problem of the formation of the size and magnitude of objects in preschoolers, as well as some methodological features of the formation of the concept of number and size in preschoolers. Emphasizing that children learn the sizes of objects mainly by sensory methods in the process of inspection, comparison and comparison, grouping, and the sizes - by measuring objects and using numbers for the purpose of quantitative assessment, the sequence of mastering values in preschool age, ways of mastering the measurement of quantities by preschoolers, as well as methodological requirements for teaching children of five years of age measuring activities. Since counting is a mathematical concept, it is an operation aimed at determining how many elements a given finite set contains, methodological features are given for the development of ideas about the natural series of numbers, a method for forming the ability to group objects), ideas about the multiplicity and singularity of objects, the formation of the ability to allocate and a certain number of objects in the world around, as well as the principles and methods of teaching counting (4-6 years). based on a comparison of two groups of objects by number.

Keywords: size, size, measurement, development, preschool age, cognition, measuring activity, measuring instrumentsб the concept of number, natural series of numbers, skills, grouping objects, plurality and unity.

Introduction.

In connection with the problem of the development of sizes by children of preschool age, the term "size" is most often used in the literature. As you know, preschool children can, in order to understand the world around them, be aware of the three-dimensionality of volumetric objects, determine the length, width, height, depth, volume of liquid in any vessel, the mass of loose substances (mainly by weighing on the palms of the hands "). The general idea of measurement using a system of measurement standards, such as liter, meter,

kilogram, preschoolers 4-6 years old acquire in the process of observing the activities of adults.

1. The sequence of the development of quantities in preschool age. Children learn the sizes of objects mainly by sensory methods in the process of examination, comparison and comparison, grouping, and sizes - by measuring objects and using numbers for the purpose of quantitative assessment.

The ability to distinguish size as a property of an object and to characterize it is necessary to understand the relationship between objects: the same in mass, different in length. Awareness of the size of objects has a positive effect on the mental development of the child, since it is associated with the formation of the ability to identify, recognize, compare, generalize. Reflection of size as a spatial feature of objects is based on perception, focus on identifying and examining an object, disclosing its features. Various analyzers are involved in this process: visual, auditory, tactile-motor.

Cognition of dimensions, on the one hand, is carried out on a sensory basis, and on the other, it is mediated by thinking and speech. Adequate perception depends on the experience of practical handling of objects, the level of development of the eye, inclusion in the process of word perception, the participation of thought processes: comparison, analysis, synthesis, etc.

The ability to perceive the size of an object begins to form at an early age in the process of object-related actions. But the relativity of magnitude makes differentiation difficult.

Preschoolers firmly fix the sign of size for that specific object that they are familiar with: "The elephant is large, and the mouse is small." They have a hard time mastering the relativity of size estimation. If you put in front of a child 4-5 toys, gradually decreasing in size, and ask to show the biggest one, then he will do it right. If you then remove it and again ask to point to the largest toy, then children 2-3 years old, as a rule, answer: "Now there is no big one."

Children of three years of age, as a rule, perceive the size of objects undifferentiated, that is, they are guided only by the total volume of the object, without highlighting its length, width, height. When three-year-olds need to find the tallest or the longest among several objects, they usually choose the largest one.

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Four-year-old children have a more differentiated approach to the choice of objects in height, length or width, if these signs are pronounced. When, for example, the height significantly exceeds other measurements, babies easily notice this. In low objects, they do not distinguish between heights at all. Most children of this age insist that there is “no height” in a “cube” that is 2 in height, 4 in width, and 16 cm in length. For them, it has a height only in an upright position, that is, when the height is 16 cm and prevails over other measurements.

Most often, children characterize objects according to any one length, which is more pronounced than others, and since length, as a rule, is predominant in most objects, it is precisely the allocation of length that the child most easily succeeds in. Significantly more mistakes are made by children (including older ones) when showing the width. The mistakes they make indicate an insufficiently clear differentiation of width from other measurements, since children show instead of width and length, and the entire upper edge of the object (box, table).

Children most successfully determine specific sizes in objects by directly comparing two or more objects. When the attention of children is drawn to the size of the object, educators prefer to use the same phrase, which is polysemantic (for example, the same in color, shape). They should still be supplemented with a word denoting a sign by which objects are compared (find the same in length, width, height, etc.).

By highlighting this or that size, the child seeks to show it (runs his finger along the length, shows the width with his open arms, etc.).

The inability to differentially perceive the size of objects significantly affects the designation of objects of various sizes by the word. Most often, children 3-4 years old in relation to any objects use the words big - small. But that doesn't mean that in their vocabulary there are no more specific definitions. In some cases, children use them with varying degrees of success. So, the neck of a giraffe is said to be long, about a matryoshka - thick. Quite often, some definitions are replaced by others: instead of thin they say narrow, etc. This is due to the peculiarities of perception, development of speech, the fact that the adults around children often use inaccurate words to designate sizes.

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It is well known that in relation to a number of objects it is legitimate to speak as large or small, since the object as a whole changes (large - small chair, large - small ball, large - small house, etc.), but when in relation to the same items we want to emphasize only any essential aspect, then we say: buy a tall tree, the child needs a low chair, etc.

Methodology

Context

These assumptions in the use of words in their relative meaning are a prerequisite for inaccuracy, which often causes deliberately incorrect expressions: a large (small) cord, a large ruler (instead of a long one), a large pyramid (instead of a long one), a thin ribbon (instead of narrow), etc. Therefore, when a child, following adults, uses such general verbal designations for the size of objects as large - small, instead of specific high, low, etc., although he sees the differences, but inaccurately reflects this in speech.

Children 4-7 years old were asked to look at boxes with pronounced lengths (in one - in height, in the other - in length, in the third - in width) and show the length, width, height of each of them. Children made the following mistakes:

• height (length, width) was shown and named only for those boxes in which it is especially pronounced;

• the height was shown by touching the top edge of the box with the hand, and not by moving the hand from the bottom up;

• they made mistakes in identifying the length and width, "replaced" one length with another.

The least number of mistakes the children made when showing and naming the length, at most - the width and height. The most successful in performance were children of the seventh year of life. Most of them correctly showed and named 3 dimensions in objects (boxes).

Based on the peculiarities of children's ideas about the size of objects, it is necessary to develop in children the idea of size as a property of an object. Children learn the ability to highlight this property along with others, using

special examination techniques: application and overlay. Practically comparing (measuring) contrasting and equal-sized objects, babies establish an "equality - inequality" relationship. Comparison results are reflected in speech using words longer, shorter, the same (equal in length); above, below, the same (equal in height); more, less, the same (equal in size), etc. Thus, initially, a pairwise comparison of objects by one property is mastered. In the future (by the age of 4), children begin to compare the size of several objects (3-4), find among them the same height (length, width) and combine them (group).

Instruments

Further, when comparing several objects, children use one of them as a reference. Application and overlay techniques are used by them to compose ordered sequences. Then children learn to create such sequences (rows) according to the rule.

At the age of 5-6 years, children make up the series of quantities not only in a visual-figurative plan, but also in representation. They can preliminarily sketch out the possible arrangement of objects in a row, determine the place of an object in an imaginary sequence, find the missing object, continue the row in two directions, tell about the way objects are arranged in a row.

Results

Thus, in younger and middle preschool age, children determine the size of objects by directly comparing them (application or overlay), in the older one, an indirect method of comparison is also used (assessment of the size of perceived objects in comparison with well-known, previously encountered in the child's experience). ; use of schematization; measurement by conventional measure). The content of children's knowledge of sizes is gradually becoming more complex. At a younger age, children learn about the ability to compare objects in size, on average - about the relativity of sizes, and at an older age - about the variability and transformation of quantities.

2. Mastering the measurement of quantities by preschool children. Currently, teaching measurement is carried out on the basis of the child's development of ideas about the number and counting skills.

The measurement activity is quite complex. But the use of conventional measurements makes measurement accessible even for young children.

A conventional measure is both the object used in the measurement and the unit of measurement in each specific case. With tape, rope, stick, step, the length of the path in the garden can be measured. With a spoon, cup, jar, glass, the volume of liquid and bulk substances is determined. The measurement of objects with conventional measures is peculiar: the unit of measurement is chosen arbitrarily, depending on the situation and specific conditions (this does not require knowledge of the generally accepted system measures).

Learning to measure leads to the emergence of more complete ideas about the surrounding reality in children, influences the improvement of cognitive activity, contributes to the development of the sense organs. Children begin to better distinguish the length, width, height, volume, that is, the spatial characteristics of objects. Orientation in individual properties, the ability to distinguish them are required when choosing a conditional measure adequate to the measured property. In measurement, the objective side of reality appears before the child from a new, yet unknown side to him.

Measuring practice activates causal thinking. Combining practical and theoretical activity, measurement stimulates the development of visual-effective, visual-figurative and logical thinking of the preschooler. Methods and measurement results, highlighted connections and relationships are expressed in speech form.

Measuring lengths and volumes allows you to clarify and deepen a number of mathematical concepts. Based on the measurement, it becomes possible to acquaint preschoolers with some mathematical connections, dependencies and relationships: part and whole, equality - inequality.

Measurement prepares the child to understand arithmetic operations with numbers: addition, subtraction, multiplication and division. Measurement exercises also make it possible to obtain numerical data that is used in composing and solving problems.

Teaching children of five years of measuring activity requires:

• the experience of a differentiated assessment by children of the length, width, height, size of the object as a whole, which allows the child to focus on the actual measuring actions;

• the ability to coordinate the movement of the hand and eyes, which is an indispensable condition for accuracy when performing measurements;

• a certain level of development of counting skills and quantitative representations for a successful combination of measurements and counting;

• the ability to generalize, which is an important factor in understanding the essence of measurement.

The preparation of children 4-5 years old for measurement with the help of a conventional measure consists in modeling the measurement (children put several equal short sticks in a row, reproducing the length of one long stick), using a measure - an intermediary. These tools are used for comparing, leveling and completing objects according to size. The water from the jug can be poured into identical glasses. Two cabinets are compared in height using the same cord, etc.

You should familiarize children with the rules of measuring a conventional measure, help them in highlighting objects, measuring instruments and results. Develop the ability to give verbal reports on the measurement. On this basis, deepen the understanding of the connections and relationships between numbers, use measurement skills to divide the whole into parts.

At preschool age, children master several types of conventional measurement. The first type should be attributed to the "linear" measurement, when children, using strips of paper, sticks, ropes, steps, etc., learn to measure the length, width, height of various objects. The second type is the determination of the volume of bulk substances (with a mug, glass, spoon and other containers measure the amount of cereals, sugar in a bag, in a bag, in a plate, etc.). Finally, the third type is the measurement of the volume of liquids. Children will find out how many glasses or mugs of milk are in a can, water in a decanter, tea in a teapot, etc.

Some teachers offer as the initial "linear" measurement, others - the determination of the volume of liquid and bulk substances. Considering that

children in practice most often deal with the measurement of lengths, preference should be given to the "linear" measurement.

Objects for measurement and measurement can be specially made by adults with the involvement of children (strips of paper, sticks, ribbons, etc.) or taken ready-made. Natural measurements are widely used: a step, a handful, arms spread apart, etc. The child himself can find objects for measurement in the surrounding environment.

Practical means of teaching measurement can be pencils, scissors, the so-called counter-equivalents - small homogeneous objects that serve for accurate counting of the number of measurements.

Counting is a mathematical concept; it is an operation aimed at establishing how many elements a given finite set contains.

1.5-2 years. Children accompany their operations with many words such as "here", "more" or numbers in any order. The child correlates each repetition with one object and one movement, thereby establishing a one-to-one correspondence between the number of objects and the number of words, movements.

2-4 years. There is an interest in comparing sets by establishing a one-to-one correspondence. The sequential naming of numerals does not mean mastering the counting process, because the child does not understand the total of the account, i.e. does not know how to answer the question "how much?" The account does not yet serve as a means of determining the quantity. Most often, the named numeral serves as a signal to stop naming the numerals.

4-5 years old. Children begin to use numbers in a specific order and distinguish the total from the counting process. They begin to understand that equal sets are always referred to as one number.

5-6 years old. They learn the sequence of naming numbers, understand that quantity does not depend on the direction of counting, that number is an indicator of quantity, understand the relationship between numbers, i.e. master the countdown.

6-7 years old. They master the counting in groups, i.e. understand that the unit of account can be not only a single subject, but a whole group.

7-8 years old. They master the counting by tens and a new activity - computing. Counting is associated with a specific set, with the determination of the quantity in a specific set, and calculation is an abstract operation, here only numbers are involved (without naming the subject).

Development of the concept of number. 3-4 years. Children use numeral words, but do not understand what a number is. At this stage, children are only able to compare different sets by establishing a one-to-one correspondence.

4-5 years old. Children can compare numbers based on comparison of sets, but they do not perceive number abstractly, without a set.

5-6 years old. Able to compare any numbers based on the transitivity property. When measuring, a number is understood as a measurement result, i.e. as the ratio of the entire value (whole) to the conventional measure (part). Understand that the number is only an indicator of quantity. There is an abstraction of numbers from specific sets.

Development of ideas about the natural series of numbers. Natural series - a sequence of positive integers in ascending order.

2-4 years. Based on the speech of adults, children begin to use numerals early: first chaotically, then orderly. Awareness of the order of the numbers occurs immediately in 2 directions: the sequences of numbers that children memorize increase, they begin to realize that each number always takes its definite place, but at this stage they do not understand why this is happening.

4-5 years old. Children cannot always answer the question of which number comes before and which number comes after. Can't name the previous numbers. For them, the row moves, as it were, forward (they understand only the last numbers). Such an idea of the natural series is called "the spatial image of the natural series of numbers." To find a number one more, children mentally or aloud begin to call word-numbers from the beginning of the series. Thus, the difference relations between the previous and subsequent numbers have not yet been mastered.

5-6 years old. Empirical ideas about the natural series as a spatial image are reconstructed into the concept of the natural series of numbers. Children begin to realize the basic principle of constructing the natural series (n` = n + 1).

Formation of the ability to group objects (2-6 years). Stage 1. Isolation, finding and naming of signs of objects. First, they teach to group according to one attribute, while all other signs should be absent or insignificant for children. The attribute by which the grouping of objects is proposed becomes more complicated with age (color – name – size – form – quantity – characteristic functions). For example: put all the cars on the bottom shelf, and the dolls on the top (by name), children have geometric shapes of the same color, but different shapes, you need to build turrets from cubes (or cylinders).

Stage 2. Grouping by two - three or more criteria. In this case, objects should differ only in these signs or other signs should be insignificant. For example: take big red cubes for construction (and the figures differ in shape, color, size), build a chain so that the figure differs in size and shape.

Stage 3. Grouping items by pattern. Signs are not verbally indicated, objects should differ in several ways, children must themselves find common signs and group them. For example: bring these toys to the table.

Stage 4. Grouping by a given attribute. The items differ in several ways, but only one is indicated. The easiest signs are color and name. The most complex are the functions of the subject. For example: name objects in the shape of a circle, collect and put in a basin toys that can be washed.

Formation of ideas about the plurality and singularity of objects (from 3 to 5 years old). Exercises or games are conducted with children, in which it is shown that the set consists of separate elements. Children are shown how a set is formed and how a set is broken down into individual elements. To begin with, a lot of homogeneous objects are taken. Attention is focused on the words: "How much?", "Many", "One", "None". For example: children collect leaves, the teacher selects uniform leaves according to the number of children and says: I have a lot of leaves. - How many leaves do I have? (A lot.) I give out one at a time. You have one, you have one, you have one. The leaves are getting smaller and smaller. I have none left. How many leaves do you have? (One.) How much do I have? (None.) I collect leaves: one for you, one for you, one for you. I have

more and more leaves. Again I have a lot of leaves. How many leaves do I have? How much do you have left?

This exercise is performed with different types of objects several times.

Later, this problem is solved with inhomogeneous sets. At 5 - 6 years old, children are shown that objects can be grouped according to different criteria, without taking into account insignificant signs.

Discussion and Conclusions

Formation of the ability to highlight 1 and many objects in the environment (from 3 to 4 years old). Stage 1. One or many objects are located on different planes (2 different tables, 2 hoops). Questions and tasks: show me where there is one, and where there are many, how many items are on the red strip, and how many are on the blue?

Stage 2. One or many objects are mixed on the same plane (bunnies and 1 squirrel). Questions: what items are there, and which one, how many bunnies, how many squirrels?

Stage 3. An exercise is proposed where one object contains many objects (one tree, and there are many leaves on it; one aquarium - many fish).

Stage 4. One and many objects are not limited to any planes or a single object. Children should mentally combine them into a group. For example: one doll at a time on a chair, carpet, closet, and in total there are many dolls.

Games at all 4 stages (the only difference is in the location of the visual material):

"Travel" or "Train with stops" (The teacher finds out how many items are at the station. If the children have answered all the questions, then they go to the next station).

Formation of the ability to compare 2 groups of objects in terms of quantity, by establishing a one-to-one correspondence (from 3 to 6 years old). There are 6 methods for establishing a one-to-one correspondence: overlay (junior return), application (junior rev.), Pairing (junior - avg.), Connection with arrows (avg.), - use of an intermediary set (old return), invoice (Wed - old return)

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Overlay. Visual material: cards with depicted objects (3 -5 pcs.), The distance between the objects should be equal to the objects themselves, small objects are given for imposition, which should be associated with the drawings by meaning.

Application. Cards with two stripes are used. On the top are items and the bottom is empty. For the application, items are selected that fit the meaning.

The method of teaching the reception of the application is based on the knowledge of the children of the overlay reception. For example, we put mushrooms on the top strip. Then we create a situation: leaves fell on the mushrooms. We put the leaves on the mushrooms and find out if there are equal parts of them. Then we sequentially drag each leaf onto the bottom strip: "the wind has blown." There is only one leaf under each mushroom. There are empty spaces between the leaves. “Will the leaves and mushrooms be equal now? If there is one leaf under one mushroom, then there are equal parts of mushrooms and leaves. "

Exercise: put as many leaves on the bottom strip as there are mushrooms on the top. If the children find it difficult, then we divide the card into cells with vertical lines or you can draw arrows from the objects of the upper strip to the lower one.

Pairing. This technique is similar to the application, but cards are not used. The objects used are related to each other in meaning. First, we arrange the objects in a row. For example, sweets yog feel the dolls. In the future, it is not necessary in a row (it is possible in a circle). The teacher finds out whether, for example, there are equal parts of squirrels and bunnies. To check the answer, you need to put one squirrel about one bunny.

Arrow connection. Children are offered a situation in which it is impossible to use the techniques they are familiar with (A cake and children are drawn. "Will all the children have enough of a piece of cake?"). In the picture, we connect one child with one piece of cake. If there are no extra children left, then everyone has had enough.

Using an intermediary set. We create a situation where it is impossible to use techniques known to children. For example: trees grow on one side of the kindergarten, on the other - too. Where do more trees grow? We use an

intermediary set - pebbles. We lay out one pebble under one tree. First, under the objects of one set, then under the objects of the second set. We draw a conclusion about the equality or inequality of objects in terms of quantity.

We give each of these techniques in two stages. First, we form in children an idea of the relationship of equality ("equally"), for this we take equal sets. And at the second stage, we form an idea of the relationship "more" and "less". We explain the concept of "more" through the word "extra", and "less" - through "not enough".

Methods of teaching counting (4 - 6 years). Learning to count is based on a comparison of two groups of subjects in terms of quantity.

Stage 1. The teacher himself leads the counting process, and the children repeat the final number after him. The independence of the number of objects from other attributes of objects is shown.

Stage 2. The teacher teaches children the counting process and introduces them to the formation of each number, teaches them to compare adjacent numbers. First, children are taught to count within 3, and then within 5, then - 10 (along Praleska Ave.). Consider an example of learning to count to three. At stage 1, the teacher offers children two groups of objects, arranged in two parallel rows, located one under one (bunnies and squirrels). Questions: how many bunnies (squirrels)? will bunnies and squirrels be equally divided? Then one item is added to one of these sets (a bunny galloped). Will squirrels and bunnies be equal now? How many bunnies were there?

At stage 2, teaching children the counting process, the teacher encourages them to adhere to the following rules:

1. To coordinate each numeral with one object and one movement.

2. To reconcile the numeral and noun in gender, number, case.

3. Do not repeat the noun after each numeral (so that the counting process is abstract).

4. After naming the last number, it is necessary to circle the entire group of objects in a circular gesture and name the final number.

5. Calling the final number, pronounce the corresponding noun.

6. Counting must be done with the right hand from left to right (so that the children have a stereotype).

7. You cannot say the word “times” instead of the numeral “one” to answer the question “how much?”.

It is necessary to rely on a comparison of two sets in terms of quantity. Questions:

How many squirrels? (two) How many bunnies? (two). Add one bunny. How many bunnies are there? How much was it? How many were added to make it 3? How do I get the number 3? (We need to add one to two, we get 3).

In the future (after the children learn to count to four), it is necessary to show the formation of the number 3 by decreasing the set by one. Thus, the formation of each number is shown in two ways, by increasing and decreasing the set by 1.

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