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Experimental Study of the Development of Quantitative Imagination in Preschool Children with Mental Impairment

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Abstract

This article reveals the state of development of quantitative imagination in mentally retarded children of preschool age. A comparative analysis of the state of quantitative imagination in mentally retarded children of preschool age compared to their peers with normal development. As a result of the experimental research, the development of the skills and abilities of mentally retarded children of preschool age was studied: correct counting, reverse counting, counting pictures on the table, counting objects in pictures placed in different order, and comparing the elements of a set.

Keywords: *quantitative concepts, Mathematics, mentally retarded children of preschool age, counting correctly, counting backward, counting pictures on the table, counting objects in pictures arranged in different orders, comparing elements of a set, recalculation, number of objects*

1. Introduction

Mastering mathematics, including quantitative concepts, is a powerful factor in the mental development of a preschool child. This also applies to mentally retarded children of preschool age, because the mathematical preparation of children of this category has a very important practical value in their social adjustment.

Number as a basic mathematical category is an abstract concept and is based on logical thinking. In children with mental retardation, lack of formation of cognitive activity, abstract thinking, formation of concepts, and low level of generalization come to the fore.

The process of mastering quantitative concepts of mentally retarded children of preschool age is qualitatively and quantitatively unique. It is expressed by insufficiently formed concepts of quantity, mechanical memorization of natural numbers without matching them with objects, great dependence of quantitative concepts on bright qualitative features, and spatial location of objects. These children have difficulty applying their existing knowledge and skills in new situations and do not know how to use them in new situations. In independent activities, such children rarely independently rely on mathematical ideas, they do not understand the meaning of their actions: counting, and measuring. Children are unaware of the significance of the actions being performed, leading to a formal mastery of mathematics.

2. The main results and findings

For this reason, we set ourselves the goal of studying the level of formation of quantitative imagination in children with mental retardation and normal development of preschool age, as well as determining the ability to use these imaginations in new conditions.

In accordance with the purpose of the study, the following experimental tasks were determined:

1) determining the empirical basis of the research;

2) choosing a set of methods aimed at studying the level of formation of quantitative imagination in children of preschool age;

3) to determine methods aimed at studying the possibility of using existing quantitative concepts in new conditions;

4) analysis of the results obtained from the stage of interpretive research;

Scientific research work was carried out in two stages:

At the first stage, the state of quantitative imagination of mentally retarded children of preschool age was determined. We relied on the "Correctional- developmental training and education" program created by Y. A. Yekzhanova and Y. A. Strebeleva and the "Ilk Cadam" and the State curriculum of the preschool education organization adapted for special education organizations in determining the testing methodology for mentally retarded children. In the implementation of the experimental methodology, the content of the program was taken into account in the "Formation of Elementary Mathematical Concepts" section of the program.

In the experiment, children were examined individually.

Task 1. Count correctly

Purpose: to learn the skill of oral counting in the correct order.

Conduct: The examiner asks the child: "Can you count? How long do you know how to count? Who taught you to count?" (A child's answer).

Instruction: "Count as much as you want" (the child counts in the correct order, the last number is determined). If the child does not understand the meaning of the task, the examiner gives an example and counts two numbers in the correct order, and the child continues.

evaluation criteria:

3 points (high level) - begins to perform the task, counts within the program or more without error (within -5 for children with mental retardation; within -10 for children with normal development).

2 points (average level) - starts the task, calculates without errors within 3-4.

1 point (low level) - starts the task, counts within 2 with the checker without error.

0 points (very low level) - does not begin to perform the task, does not understand the instructions, does not accept the help of the examiner.

Task 2. Countdown

Purpose: to learn the skill of oral counting in reverse order.

Conduct: the examiner asks the child: "Do you know how to count backwards, can you count backwards or vice versa?" (Answer of the child).

Instructions: "Count from 5 to 1 (it is determined from which number the child will start counting in reverse order). If the child does not understand the meaning of the task, the examiner gives an example: he starts counting backwards, counting two consecutive numbers in reverse order, asking the child asks to continue counting.

Evaluation criteria:

3 points (high level) - independently performs a countdown from a given number (typically developing child within -10).

2 points (average level) - begins to perform the task, independently counts in reverse order as the number line decreases.
1 point (low level) - starts the task, counts up to 5 together with the inspector.
0 points (very low level) - does not begin to perform the task, does not understand the instructions, cannot count in reverse order, does not accept the help of the examiner.
Task 3. Counting objects in a row based on instructional materials
Purpose: to learn the ability to determine the number of objects in pictures arranged horizontally on a plane.
Demonstration material: a phrase is placed in a picture from 5 objects placed in front of the examining child in a row.
Conduct: the examiner places in front of the child a picture of 5 objects placed in a row and is asked to count. If the child knows how to count, the examiner offers him to count according to the method he wants
Instructions: "Count how many pictures are on the table" (it is determined that the child counts the number of pictures without breaking the order). If necessary, in addition: "Count as much as you want" is allowed.
Evaluation criteria:

3 points (high level) - starts the task, correctly counts the number of images in the program material. Recalculation is based on visual correlation, without speaking. Based on visual perception, recount without pronunciation and determine the correctness of the final number. mentally retarded children within -5; normally developing children within -10

2 points (average level) - begins the task, correctly lists the objects in the picture based on intuitive perception. The child connects the objects in the pictures with the corresponding numbers, correctly tells the result of counting.

1 point (low level) - begins to perform the task, counts aloud, relying on intuition. When counting, the child drops pictures, says the last number incorrectly. The result will improve if the task is performed with the help of an adult. The child corrects his mistakes.

0 points (very low level) - the child does not understand the instructions, does not perform the task, looks at the pictures and says random numbers. The final number cannot be determined even with the help of adults.

Task 4. Counting objects in pictures arranged in different order
Purpose: to study the ability of children to determine the number of images in pictures arranged in different order; to determine the methods used by children to determine the number based on visual and tactile perceptions; multiplying the number of calculated subjects with appropriate numbers; determine the effect of the location of objects on the counting activity.
Exhibition material: pictures of 5 randomly arranged objects
Conduct: the examiner puts pictures of 5 randomly arranged objects in front of the child and asks him to count them. If the child correctly identifies the counting methods, the examiner allows him to sashay as much as he wants.
Instruction: "Count how many pictures are on the table" (determines the number of pictures the child counts without breaking the counting order). If necessary: You are allowed to count as much as you want.
Evaluation criteria:

3 points (high level) - begins to perform the task, counts the number of pictures without deviating from the program requirements. Recounting correctly determines the last number based on visual perception without having to pronounce it. The location of the objects does not affect the counting activity. (Retarded children within -5; typically developing children within -10)

2 points (average level) - begins to perform the task, relies on tactile perception and counts the images in the picture. The child connects the images of the objects in the pictures with the corresponding numbers, gives the correct result when recalculating

1 point (low level) - begins to perform the task, relies on intuition and pronounces the numbers aloud. The location of the objects in the picture affects the child's counting activity and incorrectly names the final number. If you repeat the task with the help of an adult, the result will improve. The child corrects his mistakes.

0 points (very low level) - the child does not understand the instructions, does not perform the task, looks at the pictures and says random numbers. The final number cannot be determined even with the help of adults.

Task 5. Comparison of collection elements

Purpose: to determine the ability to compare elements of two sets using superposition, juxtaposition methods.

Exhibition material: 3 pictures of bowls, 4 pictures of dolls

Content: the examiner draws the child's attention to the fact that 4 dolls are visiting him and puts a picture of the dolls in front of him. He asks the child to count them. Shows a picture of a bowl and asks to treat the dolls to tea. Instructions: "Dolls have come to visit us. Treat them with tea. Count the dolls and bowls, will there be enough bowls? What is more: dolls or bowls?"

Evaluation criteria:

3 points (high level) - begins to perform the task, performs actions with objects, compares two groups of sets based on recalculation, "what is more / what is less?" answers the question (children with mental retardation are within -5; children with normal development are within -10)

2 points (average level) - begins to perform the task, performs actions with objects, uses the method of juxtaposition in comparison. If he makes a mistake, he corrects it with the help of adults.

1 point (low level) - begins to perform the task, uses the method of superposition to determine the difference in the number of objects. Makes mistakes.

0 points (very low level) - the child does not begin to perform the task even with the organizational help of the examiner, or performs irregular actions with pictures: moves them in space and tries to perform some actions. He does not understand the meaning of the task.

Experimental research work with children of preschool age was carried out in a specialized preschool educational organization and in the "KIDS BOSS" non-governmental educational organization.

20 mentally retarded preschool children (experimental group) and 20 normally developing preschool children (comparative group) participated in the study.

Mentally retarded children of preschool age from the "Yulduzcha" and "Kuyoshcha" large groups participated in the experimental research work.

In the psychological development of the studied children, the underdevelopment of cognitive activity, i.e., the lack of ability to compare things and events comes to the fore. Visual-action and visual-image thinking are characteristic for them.

Sensorily, there is a slow development of feelings and perception by various analyzers (visual, auditory, tactile), which, in turn, makes it difficult to adequately target the surrounding reality. Delayed and incomplete development of perception hinders the formation of ideas about the world of objects. It is characterized by instability of attention and quick distraction in children with mental retardation of preschool age, they have difficulties in attracting attention. That's why bright objects and their images are used during

training, and various conditions are created with the participation of attractive toys. Due to low working capacity and quick distraction, the duration of training is very limited.
It is easy for mentally retarded children of preschool age to remember well-known objects and bright exhibition materials. It is difficult for them to remember verbal material.
It is characteristic that due to the slowness of thinking and the inertness of mental processes, they face difficulties in applying the knowledge acquired during the educational process in other conditions (daily life, independent activities). Children with mental retardation of preschool age should constantly repeat the material in different conditions. Preschool children with mental retardation have limited life experience. This also applies to the quantitative side. Children are not able to evaluate the quantitative aspects of subjects independently. They pay attention to the shape and color of objects, not their quantity.

In all spheres of the life of mentally retarded children of preschool age, the passivity of their activity is observed in relation to the surrounding subject activity, environmental and social events. As a result of our observation, we witnessed that preschool children with mental retardation interact differently with adults and peers. We can note that there are children who engage in communication and strive for mutual communication, who actively accept the help of the examiner, and children who do not engage in communication with others, passive, without initiative. Children's games are stereotyped, their actions are incomprehensible and meaningless. Without the help of adults, preschool children with mental retardation cannot organize eventful games. The independent game is mainly in the nature of procedural actions.

We studied the results of studying the level of formation of quantitative imaginations and the ability of preschool children to use these imaginations in new conditions through the research methodology.

In the process of experimental research, understanding of the assignment condition by mentally retarded preschoolers; way of doing the task; speech; difficulties in completing the task; receiving assistance from the examiner was recorded.

The analysis of our research work, i.e., the results of the first and second stage assignments, revealed that the level of development of quantitative imagination is different between normally developing preschool children and mentally retarded children.

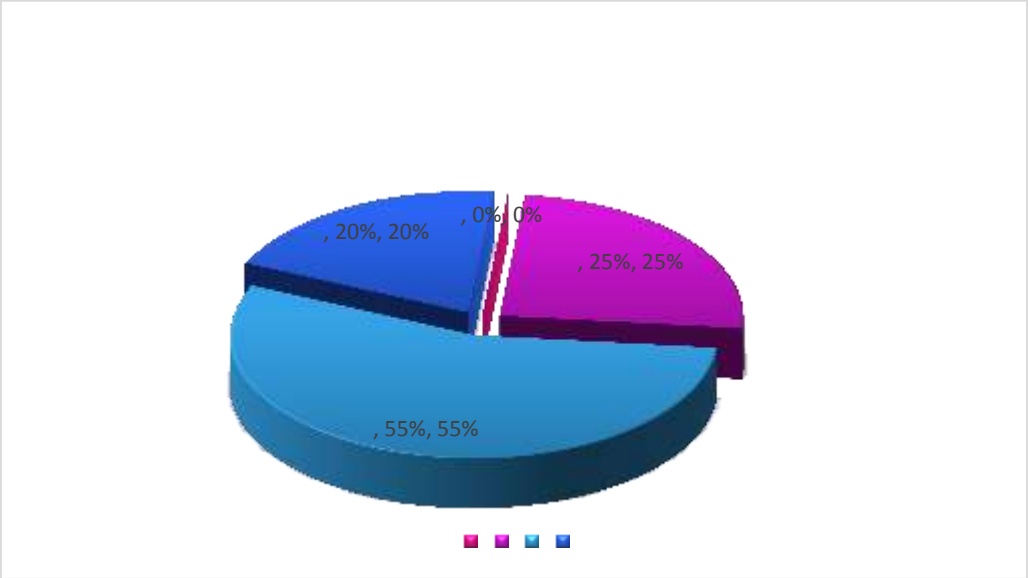
Children who participated in the explanatory experiment can be divided into 4 groups according to the level of development of quantitative imagination:
- high level (Yud) - 15-18 points;
- secondary level (O'D) - 10-14 average points;
- low level (PD) - 5-9 points;
- very low level (JPD) - from 0 to 4 points.

The results of the first stage of the explanatory experiment in the group of preschool children are presented in Table 1.

Table 1

№	Number of children	high level	middle level	low level	very low level
1	20	-	5/25%	11/55%	4/20%

The results of the first stage of the explanatory experiment in the group of preschool children are presented in diagram 1.



Thus, a very low level of development of quantitative imagination was found in 4 mentally retarded children. They are characterized by the following features: In this category, children were quickly distracted, did not understand the conditions of the task, lack of speech and did not accept the help provided by the examiner. They have not developed the knowledge of forward and reverse counting within the program material. When counting the exhibits, they looked at the pictures by touch (manipulation), named random numbers. The final number has not been determined using adults either. They did not complete the task of comparing sets with numbers and solving arithmetic problems.

11 preschool children with mental retardation were distinguished by the low level of development of quantitative concepts. These children understood the meaning of the task, began to fulfill it, but did not always achieve the correct result. Based on the increase and decrease of the series of numbers, they performed the correct and reverse counting tasks with the help of a tester. It is characteristic for them to describe the image of objects based on tactile perception or to say numbers. We witnessed that not all children of this group mastered quantitative concepts. They made various mistakes in counting. When counting a collection of items, some were left uncounted or counted twice. Preschool children with mental retardation had difficulty counting consciously. They count mechanically. Although he says the numbers correctly, he has no idea about the amount of numbers he has mastered. When asked to point to objects equal to the number he had named, he named five and pointed to a sixth or third object instead of five. Some children spelled the numbers out of order, showed the same picture twice. It was found that separation of given numbers in preschool children with mental retardation depends on their location in space. The children incorrectly named the final number and passed the pictures. With the help of the examiner, the child corrected his mistakes. They began to perform the task when they were approached on the basis of demonstrations and auxiliary questions. In the task for comparing groups of sets, mentally retarded children of preschool age do not use counting skills to determine the equality or difference of numbers. They mainly compared sets using the superimposition method. The results of studying the skills of solving arithmetical problems using an object image show that children with mental retardation of preschool age said the final result without thinking about its correctness.

5 mentally retarded children were included in the group with an average level of development of quantitative imagination. These children began to perform tasks

independently. They understood the given instructions and used the words expressing quantity and quantitative relations in speech. They independently completed the task of forward and backward counting. They completed the tasks of recalculation, comparison and arithmetic problem solving, but errors and inaccuracies were observed in some answers. When assisted by an experimenter, preschool children with mental retardation corrected their mistakes and gave correct answers.

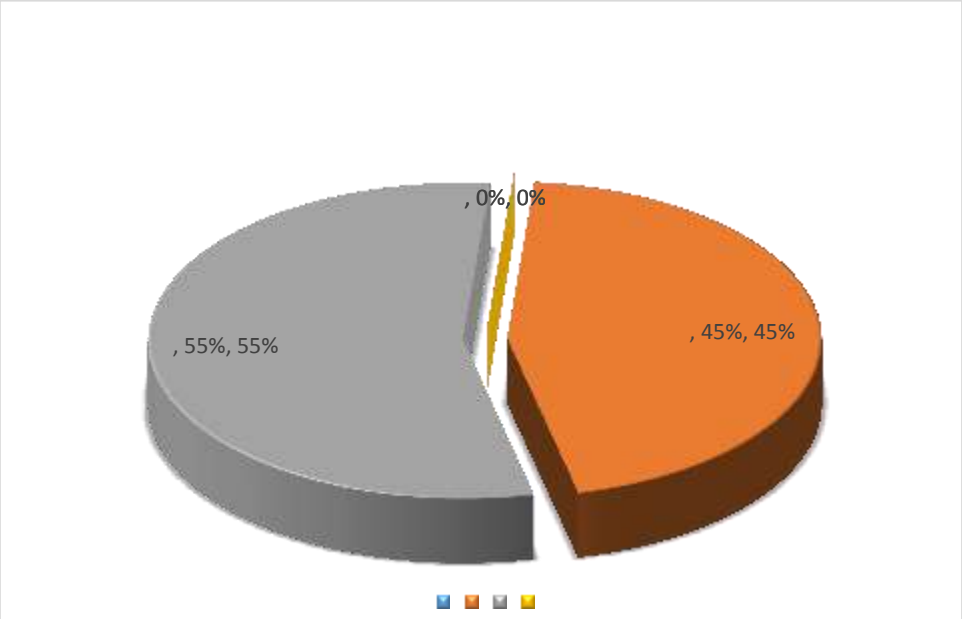
None of the mentally retarded preschoolers were included in the group with high development of quantitative relations, because they could not perform the tasks at a high level.

Table 2 presents the results of the first stage of the experiment comparing normally developing children in the experimental group

Table 2

№	Number of children	high level	middle level	low level	very low level
1	20	-	11/55%	9/45%	-

The results of the first phase of the experiment comparing the normally developing children in the experimental group are presented in diagram 2



Based on the results of the first stage of the explanatory experiment, the quantitative imagination of 11 normally developing preschool children is characterized by the average level of development. The children understood the instructions well, independently performed the tasks of forward and backward counting, comparing groups of sets, recounting with the help of visual material, and solving arithmetic problems. They mainly used practical methods to perform the given tasks. In some answers, children in this group had errors and inaccuracies, but they corrected these errors with the help of the examiner.

9 normally developing preschool children were included in the group with highly developed quantitative imagination. These children were distinguished by the fact that they performed most of the proposed tasks without errors, developed quantitative concepts, and often had knowledge beyond the program material. Children belonging to this group were more active

in using mathematical terms in their speech. From the verification methods, they used the verification methods when performing the tasks of comparing sets by number and solving arithmetical problems.

All studied children can be divided into 4 groups according to the ability to use the concepts of quantity acquired by children in a new situation:

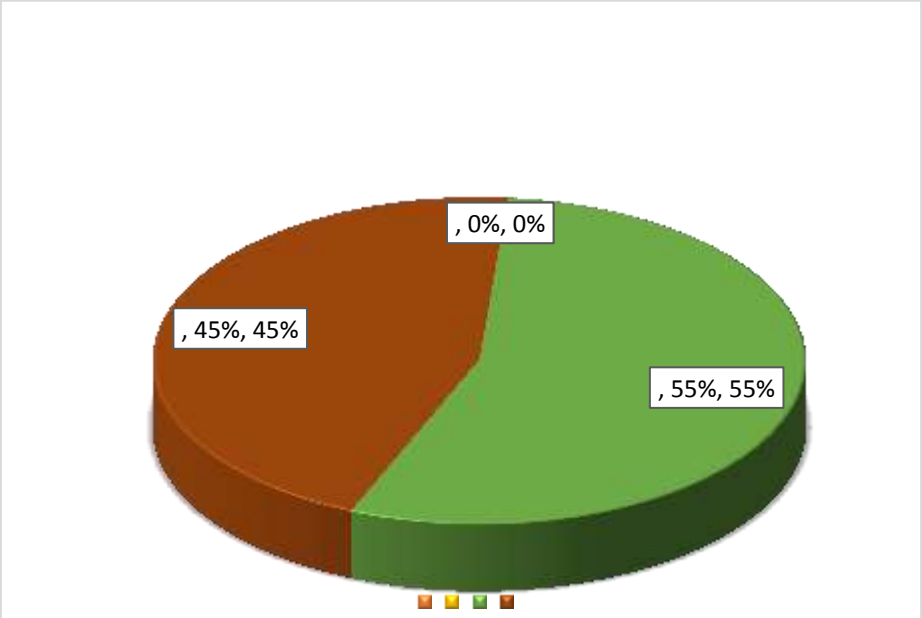
- high level (Yud) -6 points;
- secondary level (O'D) - 4-5 points;
- low level (PD) - 2-3 points;
- very low level (JPD) - from 0 to 1 point.

The results of the second stage of the explanatory experiment in the group of mentally retarded children of preschool age are presented in Table 3

Table 3

№	Number of children	high level	middle level	low level	very low level
1	20	-	11/55%	9/45%	-

The results of the second stage of the explanatory experiment in the group of mentally retarded children of preschool age are presented in diagram 3.



The analysis of the table shows that 9 preschool children with mental retardation belong to a very low level group in terms of their ability to independently use quantitative concepts in game activities. These children were very passive in the game and rarely interacted with their peers and the examiner. Despite the influence of the experimenter during the experiment, these children did not engage in the play process organized by the experimenter. Even when they had to use quantitative concepts, they struggled to apply their mathematical knowledge.

11 preschool children with mental retardation fell into the low level group. In the independent game activity, children of low level did not use quantitative concepts

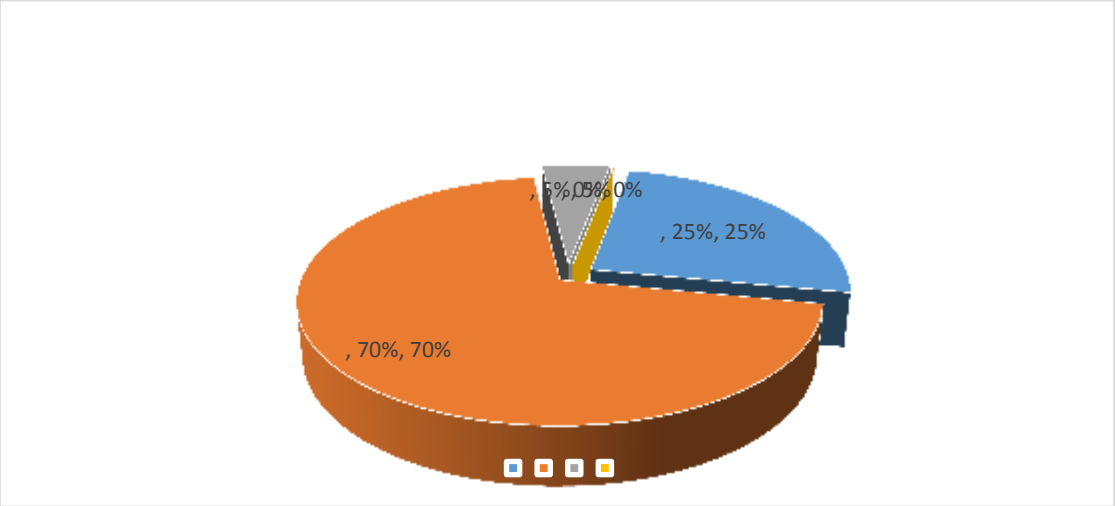
independently, but answered only the assistant questions of the experimenter. Mistakes were made when naming numbers, recalculating, and matching the number of subjects. There are almost no mathematical terms and names of numbers in their speech. The results of the study show that children are more active in the presence of the examiner. The children were interested in supporting questions and activities by the examiner. He made mistakes in counting objects, in many cases he did not correlate the number of objects. They did not fix the errors even when helped by the reviewer

Table 4 presents the results of the second phase of the explanatory experiment with typically developing preschool children.

Table 4

№	Number of children	high level	middle level	low level	very low level
1	20	5/25	14/70%	1/5%	-

The results of the second stage of the interpretive experiment with children of normally developing preschool age are presented in diagram 4.



Observing the games of normally developing preschool children showed that in the plot and content of the games, as well as in the actions of the game, children reflected familiar areas for them: household plots in the family (feeding, sleeping, walking), professional plots ("shop", "hospital", "beauty salon"). Children also played games related to TV shows and cartoons.

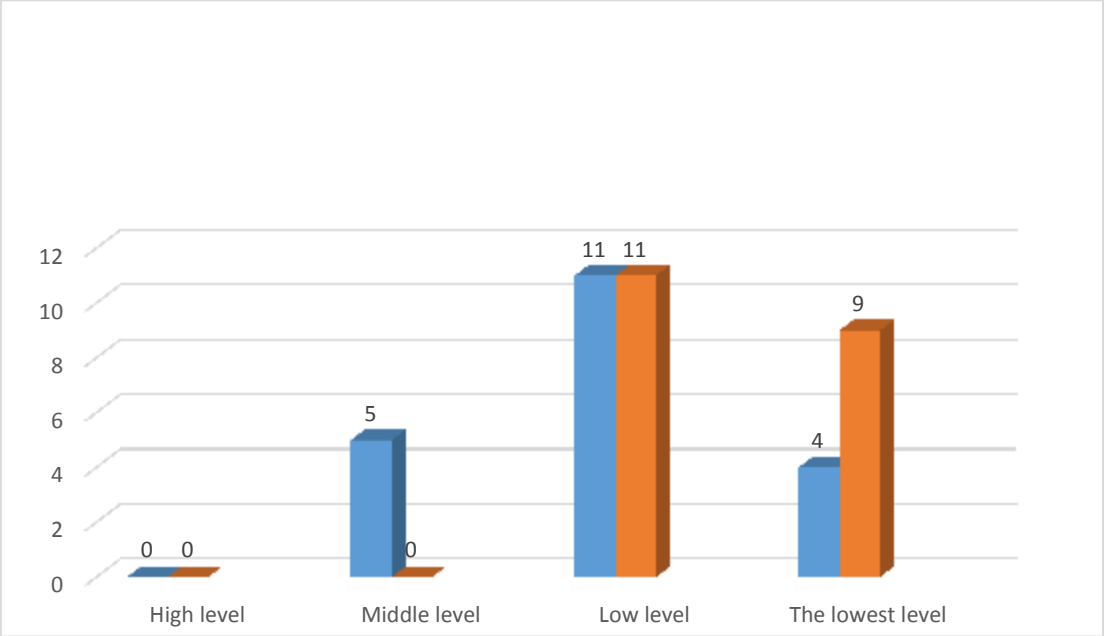
The analysis of our conducted experiments allows us to conclude that normally developing preschool children belong to different levels of using information about quantity in independent play activities. A low level is typical for one child. He did not independently use the knowledge he acquired in the training of forming elementary mathematical concepts. Quantitative concepts were not used in his playing activity.

The results of the level of formation of quantitative imagination and the ability to use concepts of quantity in independent play activities of mentally retarded children of preschool age are shown in Figure 1.

Level of development

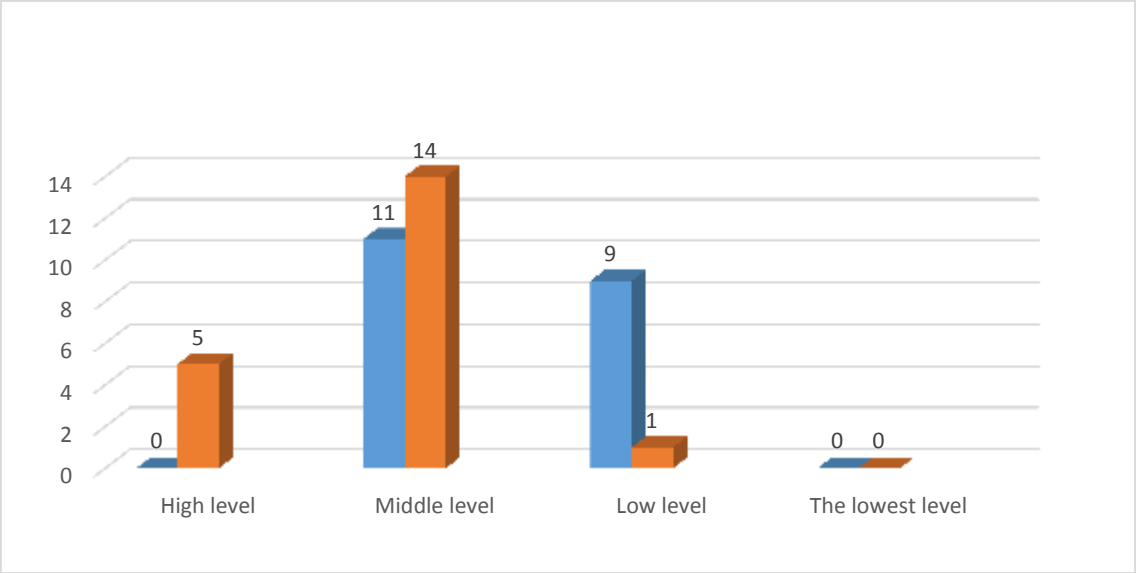
- The degree of formation of quantitative perceptions

- Being able to use existing quantitative concepts during the game



Analyzing the obtained results, we can see that the formation of quantitative concepts in children with mental retardation of preschool age is at a low level. We observed that these children mechanically memorized a series of different numbers. When performing the task of recalculating the figures depicted in the picture, the children showed that their spatial location is of great importance in determining the given amount. Children used the method of stacking and side-by-side when performing the task of comparing sets by quantity.

The results of the research showed that the development of the quantitative imagination of children of normal preschool age is moderate to high. They successfully completed the tasks of forward and reverse counting, recounting objects, and comparing sets by quantity. For them, the quantitative side of reality is important, and their spatial location may be abstract in their recalculation. However, these indicators were low in independent game activity. The results of the level of formation of quantitative concepts and the ability to use existing quantitative concepts in independent play activities in preschool children with mental retardation are shown in Table 2.



Level of development

- The formation of quantitative perceptions
- Being able to apply quantitative concepts during the game

The data obtained during the explanatory experiment showed that preschool children with mental retardation have a low level of formation of quantitative concepts and their use in independent game activities. Compared to the performance of their typically developing peers on tasks, we can see that they outperform program materials in performing computational operations.

It made it possible to determine the characteristics of mentally retarded children of preschool age (experimental group) and their normally developing peers. They did not fully use the knowledge and skills acquired by them in the "Formation of Elementary Mathematical Concepts" section during the game. Especially children with mental retardation of preschool age faced obstacles in using quantitative terms due to the fact that their speech is not well developed. Cases of quantitative terms being omitted were observed.

3. Conclusion

Deficits in the first stage of cognition - perception are observed in students with mental retardation. The perception of students with mental retardation is characterized by the fact that it takes a long time to perceive the given educational materials, it is difficult to distinguish the main things, important signs and symptoms, and they do not understand the internal connection between the parts of the whole.

The data obtained during the explanatory experiment showed that preschool children with mental retardation have a low level of formation of quantitative concepts and their use in independent game activities. Compared to the performance of their typically developing peers on tasks, we can see that they outperform program materials in performing computational operations.

As a result of the comparative analysis of the quantitative imagination of pre-school age children (experimental group) with their normally developing peers (comparative group), it was proved that the differences in the state of quantitative imagination and the ability to use them in independent game activities are important.

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