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**COGNITIVE FUNCTIONS DYNAMICS IN PRESCHOOLERS
WITH AUTISM DISORDERS UNDER REHABILITATION
CENTRE CONDITIONS**

Vasiliy Feofanov (a)*, Pavel Kislyakov (a), Nataliya Konstantinova (a), Kseniia Kozlova (a),
Natalia Belyakova (a)
*Corresponding author

(a) Russian State Social University, Wilhelm Pieck str., 4, Moscow, 129226, Russia, v-feofanov@yandex.ru,
+7(915) 156-61-55

Abstract

The present article is devoted to the analysis of the results of our study conducted on thirty-seven preschool children with autism spectrum disorder. At the first stage, the uneven development of cognitive functions (perception, attention, thinking, and memory) is found. The following main problems are identified: difficulties concerning the inability for voluntary concentration, the inability to perceive an assignment, to imitate, etc. The children are divided into two groups: the experimental group (the children with low and below-average levels of cognitive function development) and the control group (the children with average and high levels of cognitive function development). The children from the first group have had cognitive remediation lessons individually once a week during five months. The duration of one lesson is forty minutes, on average including from three to five assignments aimed at developing particular cognitive functions, depending on a child's individuality. After these sessions, it is detected that cognitive function development in children from the experimental group has a significant progress. As a result of using the mathematical method of data processing, we have confirmed our assumptions that special classes for cognitive function development have a significant influence on the development of perception, attention, memory, and thinking. Also, using the sign test, it is found that minor changes in the secondary diagnosis results of the control group in all the five methods are random.

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Keywords: Autism spectrum disorder, cognitive functions, cognitive remediation, preschool children..



1. Introduction

At present, in Russia, the necessity of the establishment of special conditions for impaired children and children with disabilities, providing recovery, rehabilitation and social adaptation, is actualized. One of the most numerous categories of children with special educational needs comprises children with intellectual disabilities (Kislyakov et al., 2017; Kislyakov, 2017). Currently, there is a significant increase of the number of children with emotional-volitional disorders in the form of autism spectrum disorder. Autism spectrum disorder (ASD) is a spectrum of psychological features with a wide variation of abnormal behaviour and problems in social communication and social interaction, as well as restricted interests and repetitive behaviours. A lot of controversy arises around the fact that intellectual, emotional or personality disorders are the primary and determining fact in autism. According to some authors, the violation of cognitive sphere is the source of deviations (Ahmedova & Feofanov, 2017; Gilberg & Piters, 1998; Frith, 1989).

Considering features of perception in preschool children with ASD, many authors define hyperesthesia as hypersensitivity to various sensory stimuli, which clearly manifests in the peculiarities of their behaviour. For example, a child clamps his ears reacting to a loud sound, or squints his eyes against a bright light, refuses to wear some clothes, claiming that it is pricking, and so forth. However, in the emotionally significant situation for a child, these phenomena may not be observed (Mamaichuk, 2007). Numerous studies and observations show that children may experience a change in sensitivity, which manifests in a general decrease in the threshold of discomfort, and, on the contrary, "overreaction" to other less important impressions. From an early age, children with ASD are particularly sensitive to such parameters of surrounding objects as colour, shape and texture. This fact can be defined as a special attention feature of preschool children with ASD. The phenomenon can cause an illusion of a good intelligence development of a child (Nikolskaya et al., 1997).

Considering features of thinking in preschool children with ASD, we can refer to the descriptions by L. Kanner (1943), who notes that children with autism can demonstrate intelligence in solving sensorimotor problems, corresponding solutions of which are in the visual field and include discretion and direct action. Therefore, at an early age, such a child can be good at object sorting by shape, size and colour, and can easily "grasp" a way of action with toys. The child shows such success, basically, when he acts directly, and during targeted training he can be less independent. Parents begin to understand early that with obvious intelligence of their child, it is very difficult to teach him anything directly.

Considering memory features in preschool children with ASD, one may note that they often have an extraordinary concentration on things important to them (Mamaichuk, 2007). In the learning process, it is easy to memorize a large volume of the proposed material, and to accurately reproduce it. But at the same time, children have difficulties in actualizing existing knowledge with a question that is asked in an unusual form. There are also possibilities of accumulating a huge mass of information within the stereotypical interests of children.

In early and preschool years, cognitive functions develop unevenly, superimposing, and transforming, stimulating and delaying each other. This requires special correction sessions within a complex approach, which has to aim at the development of all the cognitive functions in children with ASD.

2. Problem Statement

Children with ASD have cognitive deviations, but the dynamics of cognitive function development in the conditions of rehabilitation centre has not been sufficiently studied.

3. Research Questions

- How does cognitive remediation affect holistic and sensory perception in preschool children with ASD?
- How does cognitive remediation affect the sustainability and productivity of attention in preschool children with ASD?
- How does cognitive remediation affect the volume of short-term memory in preschool children with ASD?
- How does cognitive remediation affect the development level of thinking and the ability to make generalizations in preschool children with ASD?

4. Purpose of the Study

The aim of the study is to examine the dynamics of cognitive functions in children at preschool age with ASD in the rehabilitation centre.

5. Research Methods

The following methods were selected, taking into account cognitive traits of the preschool children with ASD:

- The test “Gather cut pictures” by Y.A. Strebelova.
- The test “Toys grouping” by L.A. Vegner.
- The Bourdon cancelation test.
- The test “Remember the picture” by N.R. Nemov.
- The test “Excluding unsuitable pictures” by S.D. Zabramnaya.

The study was a diagnostic experiment in nature and conducted on the basis of the disabled children rehabilitation centre “Our sunny world” (Russia, Moscow, Lescova str., 6B). The centre worked according to the program for a complex rehabilitation, integration, and social adaptation of children and youth with developmental disabilities. It also implements its author's program of integrated rehabilitation, based on methods developed by the centre experts.

The experimental group consisted of 15 preschool-aged children with ASD; the control group consisted of preschool children with ASD in the amount of 22 people engaged in no special classes for the development of cognitive functions. All the subjects could be divided by age (3 years old – 4 students; 4 years old – 8 students; 5 years old – 16 students; 6 years old – 9 students) and gender (6 girls and 31 boys).

6. Findings

Based on the analysis of the results of primary diagnosis in all five methods, 37 subjects, according to the cognitive function development levels, were distributed as follows: 2 subjects were assigned to a high level, 20 - to the average, 4 - to below average, 11 - to low. As a result, two groups of preschool children with ASD were emerged according differing in cognitive function development levels. The first group (experimental) with low and below average cognitive function development levels, consisted of 15 subjects. The second (control group) - with high and medium cognitive function development levels - included 22 pre-schoolers. This was done to send the first group of children to classes that are part of the remediation activity, in order to verify the above hypothesis.

The purpose of such lessons was to correct cognitive deviations in the children. During remediation sessions, the implemented correctional program was based on the patterns of development the preschool stage of childhood, which is a unique stage in the life of a child.

These sessions were conducted at the constant time, with each child individually once a week for five months. The duration of one lesson was 40 minutes, and on average included 3-5 assignments aimed at the development of a cognitive functions, depending on the individuality of the child, with special attention paid to the development of memory, thinking, perception, and attention. The tasks for a child were mostly offered in visual form.

After ten correctional sessions there was a secondary diagnosis of holistic and sensory perception, attention, short-term memory and thinking.

The analytical results of secondary diagnostics of holistic perception with E.A. Strebelova test «Sloji rasresanniye kartinki» [Gather cut pictures] showed that the development of holistic perception of subject picture in the experimental group increased significantly (figure 1). Subjects of this group according holistic perception development levels were distributed as follows: 1 child was assigned to a high level (6.6%) and 14 people – to the average level (93.4%). The results of secondary diagnosis in the control group changed insignificantly: the high level increased by 4.6%, and the average level - decreased by 4.6%. Only 22.8% of the control group showed some changes in the results, which may indicate their randomness.

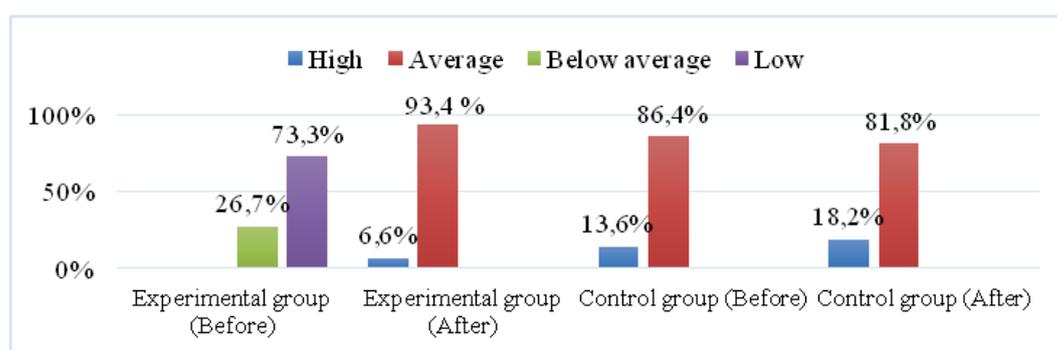


Figure 01. Dynamics of holistic perception development level in two groups of preschool children with ASD

As can be seen in figure 2 based on the results of secondary diagnostics, according to the L.A. Vagner test «Gruppirovka igrushek» [Toys grouping], the sensory perception development level in the

experimental group significantly increased. In this group, 12 pre-schoolers (80%) were assigned to average level, and 3 children (20%) to high. The results of secondary sensory perception diagnostics in the control group showed insignificant changes: high level increased by 9.1%, and the average level decreased by 9.1%. Consequently, only 27.3% of the group showed some changes in the results, which may indicate their randomness.

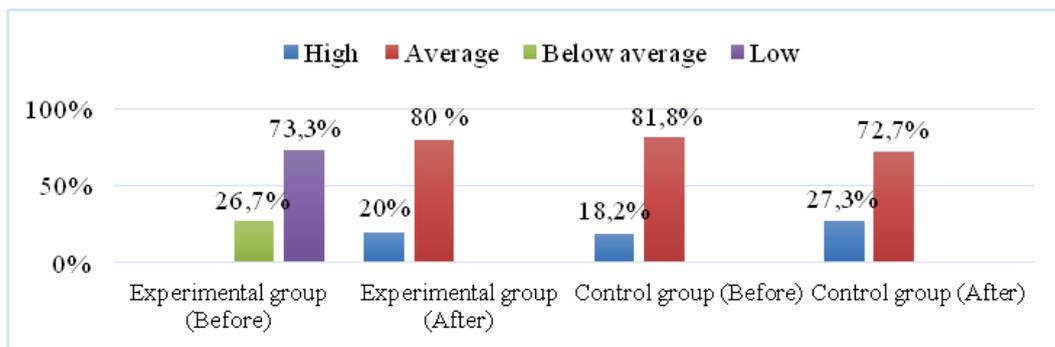


Figure 02. Dynamics of sensor perception development level in two groups of preschool children with ASD

Based on the results of a secondary diagnosis (Figure 3) with the Bourdon test, attention stability development level in the majority of children in the experimental group increased significantly: 13 pre-schoolers (86.7%) were assigned to average level, and 2 children (13.3%) - to high. The results of attention stability diagnostics in the control group showed insignificant changes: the high level increased by 9.1%, and the average decreased by 9.1%. Therefore, only 36.3% of subjects from the control group showed some results changes, that may indicate their randomness.

Thus, after cognitive remediation sessions, the experimental group had progress in development of productivity and sustainability of attention.

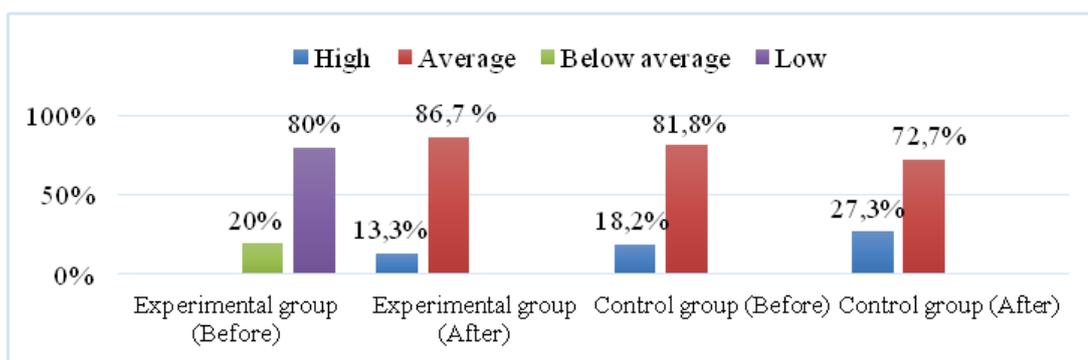


Figure 03. Dynamics of attention stability development level in two groups of preschool children with ASD

The results of secondary diagnosis with the R.S. Nemov test «Sapomni kartinku» [Remember the picture] (Figure 4), showed that the development level of short-term visual memory volume in the experimental group increased significantly: 12 pre-schoolers (80%) were assigned to average level, and 3

children (20%) - to high. Development level of short-term visual memory volume in the control group showed insignificant changes: the high level increased by 22.8%, and the average decreased by 22.8%. Therefore, only 36.3% of subjects from the control group showed some results changes, that may indicate their randomness.

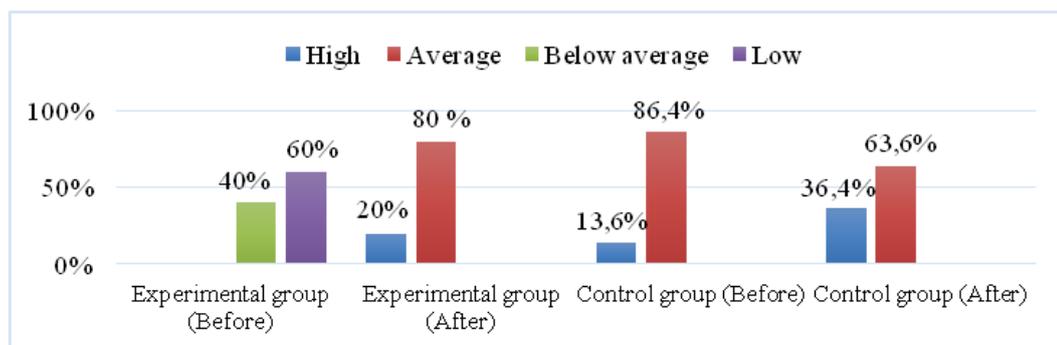


Figure 04. Development level dynamics of short-term visual memory volume in two groups of preschool children with ASD

As can be seen in figure 5 based on the results of secondary diagnostics, according to the C.D. Zabramnaya test «Isklucheniye nepodhodyashey cartinki» [Unsuitable pictures excluding], the thinking development level in the experimental group has significantly increased 12 pre-schoolers (80%) were assigned to average level, and 3 children (20%) to high. Thinking development level in the control group has insignificant changes: the high level increased by 13.7%, and the average decreased by 13.7%. Only 31.8% of the control group showed some changes in the results, which may indicate their randomness.

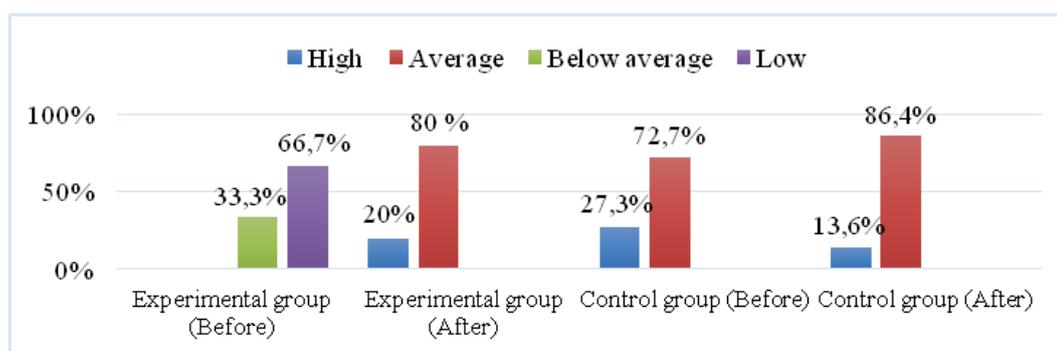


Figure 05. Dynamics of thinking development level in two groups of preschool children with ASD

Based on the processing of all results of the methods at the secondary diagnosis stage, we were able to assess the development dynamics of all subjects entering the control and experimental groups, and also to track changes of the cognitive function development levels (Figure 6).

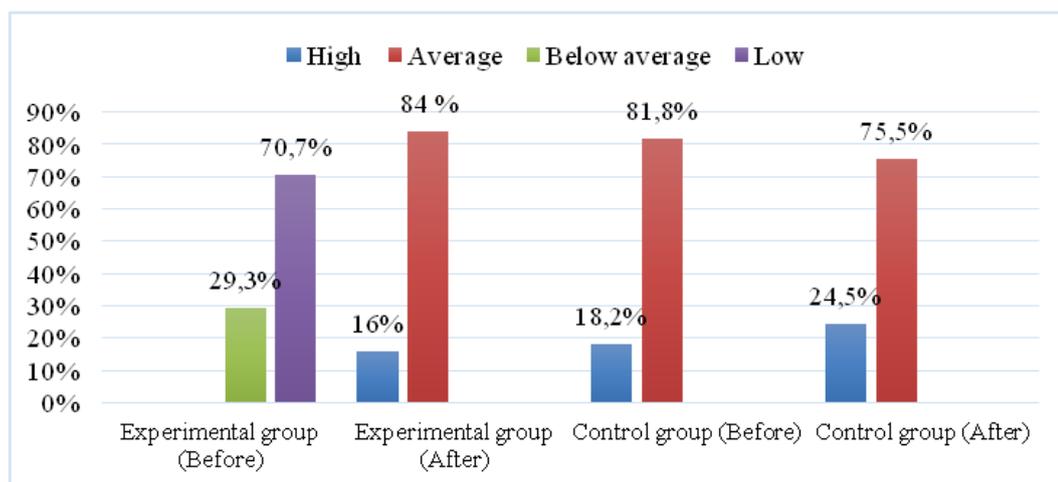


Figure 06. Dynamics of development level of cognitive functions in two groups of preschool children with ASD

According to the study findings presented on figure 6, we can see that after cognitive remediation sessions for three months in the experimental group, the indicators increased significantly. As a result, in the group the average development level of cognitive functions predominated (84%) and the high level appeared (16%). Indicators of low and below average levels fell to zero and were 0%.

Comparison of preliminary and final diagnostics allows us to assume the presence of significant differences between two results before and after cognitive remediation sessions in the experimental group. The sign test was used for confidence levels of the proposed sessions effectiveness (Table1).

Table 01. Sign test values of comparing cognitive functions development levels in the experimental group

Methods	Match differences number			Sum of negative differences	p-value ^A
	Positive	No difference	Negative		
Y.A. Strebelovatest «Sloji rasresanniye kartinki» [Gather cut pictures]	15	0	0	0	p≤0,01
L.A. Vegner test «Gruppirovka igrushek» [Toys grouping]	15	0	0	0	p≤0,01
The Burdon test	15	0	0	0	p≤0,01
N.R. Nemov test «Sapomni kartinku» [Remember the picture]	15	0	0	0	p≤0,01
S.D. Zabramnayatest«Isclucheniye nepodhodyashey cartinki» [Unsuitable pictures excluding]	15	0	0	0	p≤0,01

Note. ^Ap-value was calculated using binomial distribution table

According to the study findings in the table 1, differences are significant (p≤0.01) and therefore the null hypothesis is rejected.

Results of the cognitive function development level in the control group, which included 22 preschoolers with ASD, not engaged in special occupations, with secondary diagnosis changed slightly. This allows us to assume that changing in the data is random and increasing the levels of perception, attention, memory and thinking is possible only with the help of specially selected activities.

Thus, during the control experiment, it was found that after cognitive remediation sessions for three months the experimental group, previously having low rates, has high and medium prevailing results of cognitive function development level. The indicators of the control group of children who did not attend remediation sessions remained practically unchanged. This confirms the effectiveness of cognitive remediation in preschool children with ASD in the experimental group. Using the sign test, it was proved that the effectiveness of proposed sessions according to the all five psycho diagnostic techniques is reliable and not random since differences are significant ($p \leq 0.01$).

7. Conclusion

This study aimed at the examination of the cognitive remediation influence on the development of cognitive functions (perception, attention, memory, and thinking) in preschool children with ASD.

The analysis of literature sources confirmed the existence of problems in the development of cognitive functions in preschool children with ASD and led us to the conclusion that it was necessary to conduct special cognitive remediation sessions aimed to develop perception, attention, memory and thinking. In the framework of our study, special sessions were designed for the development of cognitive functions, the purpose of which was to correct cognitive function deviations.

Based on the outcomes of cognitive remediation sessions, we could conclude the following:

- The significant changes of the holistic perception development level ($p \leq 0.01$) of the subjects in the experimental group were proved, while the changes of these parameters in the subjects of the control group were random.
- The significant changes of the sensory perception development level ($p \leq 0.01$) of the subjects in the experimental group were proved, while the changes of these parameters in the subjects of the control group were random.
- The significant changes of the attention stability development level ($p \leq 0.01$) of the subjects in the experimental group were proved, while the changes of these parameters in the subjects of the control group were random.
- The significant changes of the short-term visual memory volume development level ($p \leq 0.01$) of the subjects in the experimental group were proved, while the changes of these parameters in the subjects of the control group were random.
- The significant changes of the development level of thinking ($p \leq 0.01$) of the subjects in the experimental group were proved, while the changes of these parameters in the subjects of the control group were random.

Based on the foregoing, we could conclude that during the diagnostic experiment and after carrying out special work on the cognitive function development in preschool children with ASD, low and below average levels of the cognitive function development disappeared completely. Therefore, the special work on the cognitive function development in preschool children with ASD in the centre “Our sunny world” really increased the development level of attention, perception, thinking, and memory.

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