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Journal for Educators, Teachers and Trainers, Vol. 12 (2)

<https://jett.labosfor.com/>

Date of reception: 04 Nov 2020

Date of revision: 03 Feb 2021

Date of acceptance: 02 May 2021

Dybina O.V (2021). Features of the formation of nonverbal thinking in preschool children with autism. *Journal for Educators, Teachers and Trainers*, Vol. 12(2). 20 – 25.

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ABSTRACT

This article reveals the features of nonverbal thinking in children with autism spectrum disorders. The article summarizes the experience of studying approaches to understanding nonverbal thinking in children aged 5 to 7 with autism spectrum disorders. Of interest is the described dual coding theory, the aspects of which should be the basis for the formation of nonverbal thinking in children with autism. The analysis of psychological, pedagogical and specialized literature allowed us to define the concept of "nonverbal thinking". Special attention is paid to the definition of criteria, indicators and the selection of methods for the experimental part of the study. The study of nonverbal thinking revealed that children with autism can name objects and use them. The practical significance of the study lies in the fact that the proposed means that contribute to the formation of nonverbal thinking in children aged 5 to 7 with this pathology can be used in the correctional and developmental work of teachers, teachers-psychologists, teachers-defectologists and parents who raise their children.

Keywords: preschool children, nonverbal thinking, features of nonverbal thinking in children with autism, means of forming nonverbal thinking.

INTRODUCTION

This article examines the problem associated with nonverbal thinking and its manifestation in children with autism spectrum disorders (hereinafter – ASD). It has been proven that nonverbal thinking in preschoolers with ASD is better developed than verbal thinking [M. Dawson, 2007]. In addition, thinking as a mental process in the correctional and developmental process with children with ASD has not been sufficiently studied in Russia. At this period, there are practically no means of correctional and developmental orientation and development for preschool children with ASD concerning the formation of nonverbal thinking.

The relevance of the topic is justified by the existing contradictions between the predominance of the development of nonverbal thinking in preschoolers with ASD over verbal thinking and the lack of intervention strategies that would take this into account and rely on it as a strong point, as well as between the proven possibility and effectiveness of using individual means to correct the characteristics of nonverbal thinking in children with ASD. A theoretical analysis of studies shows that nonverbal thinking has been a subject of study by philosophers, physiologists and psychologists. Initially, the issues of thinking and consciousness were studied theoretically by philosophers, and only later by physiologists, neurophysiologists, neurobiologists, representatives of cognitive sciences, as well as neurosurgeons [2].

In the 18th century, the great philosopher I. Kant wrote about the importance of the so-called "inner feeling", which is determined by reason and the ability to synthesize contemplation, and apperception – the ability of consciousness, characterized by the initial givenness to contemplation (without sensory cognition). In this vein, he says that the consciousness of things without their imagination (images) is impossible: "We cannot think a line without drawing it mentally." [4, p. 142]. Here he talks about the importance of our consciousness ("reason"), which determines the inner feeling. That is, sensory cognition is primary for a person; without it, apperception is impossible, which determines this type of cognition, as if creating "categories" that a person thinks or, as it is now customary to call it, a cognitive model [4]. I. Kant was one of the first philosophers to combine the empirical (sensory and practical) with the transcendental (theoretical).

From the point of view of the physiology of thinking, one of the first works in this area was "Elements of Thought" by I.M. Sechenov, in which he clearly defines thought as one of the highest products of the psychological form. In addition, he notes that the child's thought is always in the area of feeling [8]. All this means that empirical experience is primary for thinking.

The most complex and structural is the definition given in the context of studying artificial intelligence and modeling behavior, perception and thinking by A.L. Shamis. He believes that thinking as an active process of the

brain is aimed at the perception of the environment, the implementation of this process, the creation of a model of the environment that controls behavior [9].

Another lesser known German philosopher, J.G. Hamann, was one of the first to clearly formulate the idea that thought is the use of symbols, and symbols are images [2]. Also, one of the Western psychologists of our time, J. Greene, in his book "Memory, Thinking and Language", notes that human thinking is a way of performing an action rather symbolically, and not in reality [14].

One of the traditional classifications of thinking is the division of thinking into verbal and nonverbal. For example, L. DeTorne and B.A. Schaefer in "A Guide to Child Nonverbal IQ Measures" indicate that nonverbal thinking is thinking without the use of language constructions, and verbal thinking, accordingly, uses those [13]. Thus, the use of symbols and images is nonverbal thinking, about which J.G. Hamann wrote, and the realization of thought in a symbolic plane (language) is verbal thinking described by J. Greene.

It is important to understand that thinking is very closely related to symbols and images, which play an important role in perception and imagination. It is known that one of the main functions of the brain is information storage. To describe the functional analysis of the way of storing information in the brain, the term "mental representations" is used, which are expressed in two ways: propositional and visual representations. Propositional representations are similar in form to linguistic representations, and visual representations are pictures, drawings, images. S.M. Kosslyn in his article "Mental Images" experimentally revealed that visual representations prevail over propositional ones, since visual representations are remembered much more clearly and faster than their verbal counterparts [5]. It follows from this that nonverbal information is processed much faster and better.

Thus, images and symbols are used in nonverbal thinking, and the main processes of nonverbal thinking, according to L. DeTorne and B.A. Schaefer are: analysis, synthesis, analogy, generalization, comparison, building a logical sequence, switching nonverbal thinking from one image to another, as well as classification. They also highlight other processes of nonverbal thinking, presented as indicators of various tests (K-ABC, CTONI, Leiter International Performance Scale-Revised, etc.): schema construction, copying (imitation), facial gnosia (face recognition), subject gnosia (shape recognition) etc. [13].

Even in the last century, L.S. Vygotsky wrote about the relationship between thinking and speech as not identical to each other, but acting as "the basis of unity and the source of their development" [3]. One of the central theories of this work is the "dual coding theory" described by A. Paivio in the article of the same name. The dual coding theory contains two main aspects, on which we will also rely in the course of the experimental part of our work:

1. Reception, processing and storage of information in the human brain is carried out through two systems – nonverbal and verbal, represented by imagens and logogens, respectively, "which are activated when a person recognizes words and objects, manipulates them or just thinks about them" [5, p. 110].

2. "Dual coding development begins with the formation of a substrate of nonverbal representations and imagery derived from the child's observations and behaviors related to concrete objects and events, and relations among them. Language builds upon this foundation and remains functionally connected to it as referential connections are being formed, so that the child responds to object names in the presence or absence of the objects, and begins to name and describe them (even in their absence)" [5, p. 116].

According to the results of empirical studies, for example, M. Dawson and others, nonverbal thinking in children with ASD in the preschool period exceeds the indicators of verbal thinking in the Wechsler's test batteries and Raven's matrices [12]. Also, this is noted in the study of R.M. Joseph, H. Tager-Flusberg and C. Lord on the ratio of levels of verbal and nonverbal thinking in children of preschool and primary school age [15]. Other researchers, such as S.L. Bishop, indicate that a high rate of nonverbal thinking decreases when children reach primary school age [11].

O.S. Nikolskaya and M.Yu. Vedenina, in their work, note the fragmentation of the perception of the surrounding world picture in children with ASD, which is further reflected in such thought processes as analysis and synthesis. Using the Kohs Block Design Test as an example, they notice that "construction for these people occurs as a reproduction of a monolith of a sample, outside of its analysis, division into elements and assembly of a new whole, consisting of selected parts" [6]. F. Happé notes that the analysis and synthesis of the whole is given to children with ASD much more difficult than the analysis and synthesis of individual objects [1].

T. Mecca, describing the results on the Wechsler nonverbal subtests (WISC-III), points out the following features: in the Construction of Blocks subtest (Kohs Block Design Test), the subjects use two strategies – an analytical route (figure division) and a synthetic route (figure division). According to the studies of F. Happé and W. Frith, children with ASD show rather low results in the Encryption and Sequential Pictures subtests. The Encryption subtest evaluates a person's ability to associate a number with a symbol and retain these associations in memory in order to use this information to complete a task as quickly as possible, and also assesses a person's ability to learn automatic behavior, since it requires associations to be performed quickly and accurately. It also includes other cognitive components such as attention, cognitive flexibility, and hand-eye coordination. According to Simchemens, the Sequential Pictures subtest requires a child to place a series of pictures in a logical sequential order. This subtest assesses the ability of perceptual analysis, as well as the ability to integrate all available information. W. Frith, A. Leslie and S. Baron-Cohen suggested that the low results found in the two previous

subtests are explained as deficiencies in the mental model, which is characterized by the ability to know about mental states of oneself and others and their causes [16].

Studies show that children with ASD demonstrate a higher level of performance in tests for visual-spatial abilities, and lower in tests for assessing abstract thinking and the formation of conceptual representation (ie mobile intelligence – the ability to apply prior knowledge in a new environment) [16]. E. Nolan provides similar data that children with ASD have difficulties in building the bigger picture, which consists in transferring prior knowledge to new circumstances. He also notes that children with ASD tend to think rigidly – they do not change their view from the angle of new information. It is because of these developmental deficiencies that children with ASD experience a lag in play activity and impairment of imagination [17].

E.C. Macedo demonstrated that preschool children have significantly lower rates of concrete and abstract reasoning than the average population. F. Happé and W. Frith note that children with ASD have difficulties in tasks requiring planning, flexibility and inhibition [16]. In the works of J.N. Miller and S. Ozonoff indicate a general lack of flexibility in cognitive functions in children and adolescents with ASD [10].

All the above-mentioned features of nonverbal thinking in children with ASD can and should be used as the basis for building a correctional and developmental process, in which the stronger points – synthesis and visual-spatial abilities – will act as a support.

STUDY PROGRAM

The purpose of the article is to develop individual tasks for children with autism, aimed at the formation of nonverbal thinking. On the basis of studies of the formation of nonverbal thinking in preschool children with ASD, we clarified the concept of “nonverbal thinking”, which is considered as a type of thinking without the use of linguistic structures and is the basis of verbal thinking.

The experimental work was carried out with the consent of the parents on the basis of the kindergartens of Tolyatti. The study involved 25 children with early childhood autism (ECA). The purpose of the experiment is to determine the level of formation of nonverbal thinking in children aged 5 to 7 with ECA.

For our study, it is important to examine the level of formation of nonverbal thinking in children aged 5 to 7 with autism. In order to implement the experiment, a diagnostic card was developed containing criteria, indicators and diagnostic techniques (Table 1).

Table 1: Diagnostic card

Criterion	Indicators	Diagnostic techniques
The level of development of nonverbal analysis of the whole and its parts	- the ability to analyze the whole; - the ability to analyze parts of a whole.	Modified subtest called Kohs Block Design Test (author: D. Veksler) Raven's modified Coloured Progressive Matrices (author: J. Raven)
The level of development of nonverbal synthesis of the whole and its parts	- the ability to carry out the synthesis of the whole; - the ability to synthesize parts of a whole.	Modified subtest called Kohs Block Design Test (author: D. Veksler) Shape Addition Modified subtest (author: D. Veksler) Raven's modified Coloured Progressive Matrices (author: J. Raven)
The level of development of nonverbal comparison	- the ability to compare the properties of nonverbal objects; - the ability to non-verbally determine the differences and similarities of objects.	Raven's modified Coloured Progressive Matrices (author: J. Raven)
The level of development of non-verbal generalization	- the ability to non-verbally identify the similarities and differences of objects; - the ability to non-verbally generalize and highlight groups of objects.	Raven's modified Coloured Progressive Matrices (author: J. Raven)
The level of nonverbal analogies ability	- the ability to non-verbally match and compare objects; - the ability to find the like.	Figured Analogies Modified subtest of the Cognitive Abilities nonverbal test batteries (author: S. Frederick)
The level of development of building a nonverbal logical sequence	- the ability to build a nonverbal logical sequence.	Sequential pictures Modified subtest (author: D. Veksler)

One of the features of organizing, conducting and analyzing the results of the ascertaining experiment was the processing of the results. When processing the results, the following criteria are taken into account:

- independence in performing the task;
- sensitivity to various types of assistance.

Thus, the processing of the results of all diagnostic techniques was carried out according to two general sections – the main and additional scoring system. Accordingly, the evaluation of the results is also common for all diagnostic techniques.

Main scoring system:

4 correct executions out of 4 attempts (in the Raven's Progressive Matrices – completing the entire third block A9-A11) – 5 points;

3 correct answers out of 4 attempts (in Raven's Progressive Matrices – completing the entire second block A5-A8) – 4 points;

2 correct answers out of 4 attempts (in Raven's Progressive Matrices – completing the entire first block A1-A4) – 3 points;

1 correct answer out of 4 attempts (in Raven's Progressive Matrices – partial completing any of the blocks) – 2 points;

0 correct answers out of 4 attempts – 1 point.

Additional scoring system:

1 point – the child does not perform the diagnostic task and does not accept the demonstration and help of the experimenter.

2 points – the child completes the task partially and only after the demonstration and help of the experimenter.

3 points – the child completes the task only after the experimenter's help.

4 points – the child performs the task only after showing by the experimenter.

5 points – the child completes the task independently.

The analysis of the conducted techniques allowed us to conditionally single out the levels of formation of nonverbal thinking in children aged 5 to 7 with autism.

A very low level (40%) is characterized by the lack of the ability to non-verbally analyze and synthesize the whole and its parts, the lack of the ability to compare the properties of nonverbal objects and to non-verbally determine the differences and similarities of objects, the ability to non-verbally generalize and highlight groups of objects. The child does not know how to non-verbally match and compare objects, find similar and build a nonverbal logical sequence.

The low level (20%) is characterized by a partial ability to non-verbally analyze and synthesize the whole and its parts, non-verbally generalize and highlight groups of objects. There is no ability to match objects and compare them, find similarities and build a nonverbal logical sequence.

The middle level (40%) is characterized by an almost complete formation of the ability to analyze and synthesize the whole and its parts, as well as the ability to non-verbally generalize and highlight groups of objects. The child can partially determine the differences and similarities of objects, but finds it difficult to non-verbally synthesize the whole and its parts, build a nonverbal logical sequence and find the like.

The high level (0%) is characterized by the complete formation of the ability to analyze and synthesize the whole and its parts, non-verbally generalize and highlight groups of objects. Partially formed are the abilities to determine the similarities and differences of objects, non-verbally synthesize the whole and its parts, build a logical sequence and find the like.

A very high level (0%) is characterized by the complete formation of all criteria and indicators of nonverbal thinking: the child is able to analyze and synthesize the whole and its parts, non-verbally generalize and highlight groups of objects, determine the similarities and differences of objects, build a nonverbal logical sequence and find the like.

The findings can be influenced by offering children individual tasks. Individual tasks for children aged 5 to 7 with autism were developed taking into account the peculiarities of their nonverbal thinking. Tasks were offered to each child individually with complications. Complications were carried out along the following lines: from the ability to analyze objects to the ability to non-verbally determine the differences and similarities of objects, from the ability to build a nonverbal logical sequence to the use of these skills in practical activity.

RESULTS

The results of the control experiment indicate that:

- the highest level of formation of nonverbal thinking with the help of individual tasks was revealed according to the criteria of nonverbal generalization, comparison, analysis and synthesis (from 40% to 60% – from low to medium level);

- the level of formation of nonverbal analysis and synthesis (from 40% to 58% – from low to medium level) and non-verbal logical sequence (from 30% to 48% – from low to medium level) increased;

- less significant results were obtained according to other criteria – nonverbal synthesis (from 40% to 46% with a transition to a higher level – middle) and nonverbal analogies (an increase within 10% without an increase in the level of formation).

The results of the control experiment showed positive dynamics in the formation of nonverbal thinking in 5-7 year old children with ASD. Children have improved their results and almost all criteria have risen to one level, they

also have almost completely formed nonverbal analysis and synthesis, generalization, comparison. Children could non-verbally compare objects, combine them into groups according to common characteristics, build a logical sequence of actions in a series of pictures, highlight the features of objects in general and combine them, find some pictures by analogy.

CONCLUSION

In the course of the study, we established the relevance of the problem of the formation of nonverbal thinking in children aged 5 to 7 with autism spectrum disorders through individual tasks in the correctional and developmental process. This problem requires further theoretical and empirical study.

The experiment showed the possibility of using individual tasks in accordance with the characteristics of nonverbal thinking in children aged 5 to 7 with ASD, taking into account the individual characteristics of the development of nonverbal thinking in children of this sample, as well as ensuring the ability to transfer the acquired skills to objective (didactic) material. In the course of the experiment, children gradually and at different rates of mastering the material, were included in the activity, gradually improving their result.

Acknowledgements. The author is grateful to the student P.A. Abramova for her help in collecting data for the study.

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