

PSYCHOLOGICAL AND CLINICAL CHARACTERISTICS OF PRESCHOOL CHILDREN WITH LANGUAGE DISORDERS

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Abstract. The work has a theoretical-practical specificity, through which the analysis and synthesis of the literature in the field of speech therapy is carried out, regarding the evolution and development of language in children, reflections on language disorders, and finally we studied dysarthria, as an exponent of language disorders found in preschool age. The clinical and speech therapy symptoms encountered in dysarthria are described, the psychological and clinical characteristics of children with dysarthria are specified. Also presented is the mini-psycho-speech investigation of two categories of preschoolers, with dysarthria and typical development of 5-6 years; the purpose, the hypothesis, the research methods and the results of the assessed children. The purpose of the investigation consists in: evaluating the language disorder in preschool children 5-6 years old, detecting children with dysarthria disorder, evaluating the level of development of thinking and memory, compared to preschoolers with typical development. The screening method was applied to identify children with dysarthria and methods to evaluate memory and thinking. The scores of preschoolers with dysarthria show the insufficiency of the development of language, memory and thinking, compared to the development of these aspects in typical preschoolers.

Keywords: preschool children with dysarthria, screening, comparative study, language, memory, thinking.

Introduction

Language development includes several specific features depending on the period of the child's development. The most important period for a child with a predisposition to dysarthria is the preverbal period. Мастюкова Е. [9] highlights the moments of language development in the preverbal period:

- lack in the emergence of the revival process,
- lack or delay of cooing;
- appearance of foreign, shrill, roaring, screaming sounds;
- dysregulation of the breathing rhythm and the tendency to emit sounds during inspiration.

Gradually, during the development of language, some imperfections caused by muscle paretics appear, which is dangerous if these disorders are overlapped with various somatic diseases. Consequently, the language does not develop within the limits of normality corresponding to the age and, subsequently, lead to the installation of language disorders, but also to disturbances in the development of mental processes with extension during the school period.

In speech therapy practice, language disorders have a high frequency in the preschool period, and dysarthria due to its varied typology and symptoms requires complex, often interdisciplinary intervention, the pseudobulbar form of dysarthria being highlighted in most cases. From a neurological point of view, children's pseudobulbar dysarthria has a complex pathogenesis: together with the central spastic paralysis of the muscles of the speech apparatus, as a rule, extrapyramidal disorders of muscle tone, various hyperkineses and other motor disorders appear. Pseudobulbar dysarthria can be observed in children without pronounced motor disorders who were under the influence of various adverse factors of prenatal, natal and early postnatal development, such as toxicosis of

pregnancy, acute and chronic diseases of the mother during pregnancy, mild asphyxia, birth injuries, Rh-conflict situations, acute infectious diseases of children at a very young age, etc.

In the anamnesis of the child with symptoms of pseudobulbar dysarthria, excessive motor restlessness, constant and unreasonable crying, persistent sleep disturbances, weakness of crying, refusal of the breast, difficulty in grasping and holding the nipple, lethargy of the act of suggestion, frequent states of suffocation, abundant regurgitation and rapid fatigue, somatic weakness are mentioned, sometimes the convulsive syndrome is specific. Indicators of children's psychomotor development vary from normal to severe delay.

In a significant number of children with dysarthria, language and communication development develops slowly, with long speech delays. The first words appear at the age of 1.5-2 years, expression through sentences at 2-3 years, sometimes at 4 years, with serious phonetic disorders. In parallel, neurological symptoms are present, which are detected during special examination using functional techniques. The presence of an organic lesion of the central nervous system is the main criterion in the diagnosis of pseudobulbar dysarthria.

The gross/gross motor range of children with dysarthria is characterized by slow, awkward, constrained, undifferentiated, unproductive and aimless movements. Children suffer limitations of movements in the upper and lower extremities, synkinesis, muscle tone disorders, which signify extrapyramidal insufficiency [9]. The Romberg position is positive – the increase in muscle tone of the hands when they are raised, a slight tremor of the fingers, the movement of the tongue towards the affected side and a slight hyperkinesia of the tongue are recorded/witnessed. The insufficiency of general motor skills, in preschool children with dysarthria, is evident when complex motor acts are performed, demanding exact self-control of the movements performed by involving certain muscle groups and in the spatial and temporal organization of the movements. Fine motor disorders are also characteristic, manifested by disturbances in the precision, speed and coordination of movements. Since the kinesthetic memory

of movements is reduced, exercises involving the fingers are very difficult to perform. A significant correlation was established between the level of underdevelopment of manual and articulatory mobility. The articulatory and facial muscles in children with dysarthria undergo changes in tone, accompanied by hyperkinesia, paresis.

All the described symptoms, present in pseudobulbar dysarthria, can appear in a non-accentuated form, if in children there are no diseases of the musculoskeletal system. All the characteristics of verbal motor skills in preschool children with dysarthria are due to insufficient functioning of the motor nerves involved in articulation [13]. Due to the injury of the hypoglossal nerve, the movements of the tongue are limited to the side, up, forward, the root of the tongue is passive, the back of the tongue is tense, the weakness of one half of the tongue can be observed, the tongue is restless, tense, the movements are uncoordinated, of a reduced amplitude, the increase in fatigue of the tongue muscle is characteristic, as well as the increase in salivation. Damage to the glossopharyngeal and vagus nerve leads to insufficiency in the contraction of the soft palate, a lateral deviation of the tongue, with a slight paresis of the palatine veil on the opposite side. The insufficiency of the innervation of the articulatory organs affects not only the separate articulation of sounds, but also the possibility of switching the articulatory movements necessary for each sound. For the same reason, the muscles of the lower jaw cannot contract to close the mouth, it remains slightly open.

The asymmetry of the facial nerves causes the slight smoothing of the nasolabial fold on both sides, conditioning the swelling on one side of the cheek [12]. Often, there are difficulties in raising the eyebrows and alternate closing of the eyes (simultaneous closing of both eyes or closing of only the right eye), which is associated with damage to the facial nerve; the differentiated movements of the lips, the tip and the back of the tongue are disturbed, because the rigidity of the movements is highlighted, the impossibility of performing complex movements, or due to motor restlessness, hyperkinesia of the tongue and

facial muscles, the difficulty or impossibility of finding and maintaining the position/posture/place of sound articulation, synkinesis when opening the mouth: drooping of the eyelids; movements of the lower jaw when lifting the tongue up, etc.). The switching speed of the articulatory movement's changes, because the perception of the series of articulatory movements is disturbed, which leads to the appearance of perseverations and chaotic permutations [4]. Thus, the movements of the facial muscles and the articulatory apparatus are characterized by rapid exhaustion, low quality, imprecision, slowness, low effort. In the case of dysarthria, in children, not only the motor aspect of the verbal system suffers: the kinesthetic perception of the articulatory positions is disturbed, the kinesthetic afferent is deregulated by delaying the integration of the various functional systems that are directly related to the speech process (the motor-kinesthetic, auditory and visual).

Verbal motor disorders are the main pathological link in pseudobulbar dysarthria [2, 3]. The extended motor condition causes serious disturbances in the phonetic side of language and communication: articulation, voice and other prosodic components of language suffer, and it worsens in spontaneous speech. Verbal breathing is closely related to voice formation, therefore melodic intonation disorders caused by respiratory insufficiency are the most persistent symptom of dysarthria. These disorders affect the intelligibility and emotional expressiveness of speech along with mild paresis of the muscles of the tongue, lips, soft palate, vocal cords, laryngeal muscles, changes in muscle tone, and mobility restrictions. The voice also undergoes changes, such as the strength or intensity of the voice is weakened and may progress to disappearance during speech), there are deviations in the timbre of the voice (deaf, unmodulated, hoarse, monotonous, strained, intermittent, etc.), the absence or the insufficiency of voice modulation, of the intonational structure of the sentence; disturbances occur in the coordination of breathing, phonation and articulation.

Simultaneously with the pathology of language and communication, in the child with dysarthria, psychological disturbances were recorded at the level of

attention, memory, the emotional-volitional sphere and delays in the development of higher cortical processes: spatial gnosis, phonetic analysis, constructive praxis, the appearance of the phenomenon of fatigue psychic, expressed by rapid exhaustion (fatigue) of nervous processes. Children's attention is characterized by a low level of stability and switching, the impossibility of concentrating for a long period of time, of distributing attention to a certain object [5]. Significant deviations were found in auditory and visual memory. Difficulties in memorizing individual words, logical and semantic memorization of the text are noted. Among the characteristics of the emotional-volitional sphere of children with dysarthria is a slight excitability, instability of mood, which often leads to behavioral problems. Some children have emotional outbursts. In the diagnosis of dysarthria, some difficulties also arise, therefore it is necessary to resort to the differential diagnosis between language disorders. Differentiation of speech disorders allows for a thorough and in-depth examination of children, taking into account not only all components of verbal activity, but also a number of non-verbal functions, as well as physical, neurological and psycho-pedagogical condition. In addition to the state of the motor analyzer, the motor function of the articulatory apparatus and its anatomical structure, speech therapy examination of children is supplemented by methods for determining the general psycho-physical state and neurological state.

The analysis of the symptomatic manifestations in dysarthria, in order to distinguish it from similar speech disorders, especially in the mild forms of dysarthria (which is deleted), highlighted that the key difficulty, in the category given by children, are phonetic-phonemic and phonation disorders.

The phonetic (production) side of language resides in a close interaction between phoneme pronunciation and voice prosody. A variety of phonetic means (tempo, rhythm, stress, intonation) interact, determining both the semantic content and the speaker's attitude towards the content. In children with dysarthria, the mentioned disorders affect the intelligibility and emotional aspect of speech,

displaying monotony and inexpressiveness, and in most cases, they hardly reproduce the main types of intonation: interrogative, narrative, exclamatory. The timbre of the voice is closely related to the emotional state of the child, and in cases with a predominance of the inhibition process, the timbre is low, the voice is quiet or muffled, unmodulated, and in the situation of excitement, the timbre is high, the voice is loud, crackling, breaks into falsetto. Likewise, the pace of speech is specific, for some it is accelerated, for others it is slow. In both cases, the sonority of a consonant or vowel in the syllable changes significantly. In a fast rhythm, the vowels may disappear completely, and in a slow rhythm, the syllable is lengthened due to the extension / stretching of the vowel. All this, in one way or another, affects the speech, which becomes either too hurried, accelerated, or extended, monotonous [17]. The rhythm of speech is irregular, changeable, the emphasis in words is placed incorrectly. Some children do not notice that they pronounce certain sounds incorrectly, but pay attention to similar defects in someone else's speech, as well as in their own speech, reproduced by the tape recorder, others do not notice distorted pronounced sounds either in their speech or in the speech of others. This phenomenon depends on the sounds affected, disturbed and the origin of the sound disturbance [15, 18].

Thus, we can *conclude* that some pronunciation disorders may be based on disorders of auditory and phonetic perception of a secondary nature. This is very clearly manifested in children with pseudobulbar dysarthria, the severity of the sound pronunciation disturbance in this case depends on the severity of the dysarthria itself.

1. Dysarthria is a language and communication disorder, characterized by a combination of disorders of verbal components: articulation, diction, voice, breathing, mimicry, melodicity, intonation.

2. Dysarthria is identified during the preschool period of development and induces difficulty in differential diagnosis and corrective intervention.

3. Dysarthria is characterized by the presence of symptoms of organic damage to the central nervous system: insufficient innervation of the articulatory organs, impaired muscle tone in the form of erased paresis.

4. Dysarthria often represents a comorbidity of Infantile Cerebral Palsy (ICP), and in such a situation the differential diagnosis is paramount. Dysarthria is often the secondary defect of paralysis [7, 8,9,10], in which the limitation of the amplitude of movements, spasticity and muscle stiffness, and mental imperfections of the order of borderline intellect, in happy cases, are attested.

In this sense, we started the psycho-logopedic investigation of preschool children with language disorders.

Research objectives

The purpose of the investigation consists in: evaluating the language disorder in preschool children 5-6 years old, detecting children with dysarthria disorder, evaluating the level of development of thinking and memory, compared to preschoolers with typical development.

Research objectives:

- the theoretical-analytical study of specialized literature;
- selection of psychological and speech therapy examination methods;
- selection of subjects;
- mathematical processing of experimental results.

Hypothesis: we believe that through screening we will identify preschoolers who have dysarthria among those with language disorders, and the comparative evaluation of the thinking and memory of preschoolers aged 5-6 will provide useful information about the level of development of these processes and the existing differences between categories of preschoolers.

Participating subjects: 16 preschool children 5-6 years old with language disorder, from which we selected 6 preschoolers with dysarthria; 6 preschoolers with typical development.

Research methodology:

➤ *Screening method* (detection of children with dysarthria)

a) identifying the specifics of the language development of 5-6-year-old preschoolers with dysarthria and with typical development:

- *Independent speaking*
- *Assessment methods for preschool children with dysarthria:*

b) methods for evaluating mental processes: memory and thinking

• *Visual memory and auditory memory assessment tests*

I. Visual memory assessment test

Purpose: highlight memory processes: fixation, retention, updating

II. Auditory memory evaluation test (digits)

Purpose: assessment of auditory memory

• *Methods of evaluation of thinking*

Purpose: highlighting the ability to conserve quantity; highlighting the possibilities of abstraction (thinking) of concrete thinking operations (analysis, synthesis, comparison)

I. Conservation of quantity.

II. The ability to abstract – thinking operation.

III. The ability to generalize – thinking operation.

The results of the independent speaking screening method

Aim: to identify children with dysarthria language disorder.

Method Independent speaking is achieved by using the educational material The Alphabet in Pictures. The analysis of the results of the 16 children with language disorders helped us to identify the children who have dysarthria-like language disorders. Out of 16 children with a language disorder, we detected 6 children with pronounced disorders. Convincing and helpful signs were: defective pronunciation and articulation of sounds and component words, impossibility of maintaining the sound articulation position, incorrect and strained coordination of the articulatory apparatus, facial muscles (of the round muscle of the mouth) tense, strained; shallow and arrhythmic breathing, salivation. Thus, we detected 6 children who we assume have dysarthria. I talked to the parents and recommended to the parents a visit to the neurologist and an electroencephalogram investigation.

In the table below we indicate the problems in the pronunciation of sounds encountered by children with dysarthria.

Table 1. *Screening of children with specific manifestations of dysarthria*

| Children / sound position | <i>initial</i> | <i>medial</i> | <i>final</i> |
|------------------------------|------------------|---------------|--------------|
| <i>1st child</i> | R, S, Ş; T,D | Ṭ; S; Ş | |
| <i>2nd child</i> | C, G, D, R, H | R, S, D, H | R, S, Ş |
| <i>3rd child</i> | L, P, R, S | L; R | L, R, S |
| <i>4th child</i> | Ṭ; Z; Ci, Gi | Ṭ; S; Z | |
| <i>5th child</i> | R; Ş, S, Z, F | R; Ş; S | R, Z, S |
| <i>6th child</i> | L; G, J, S | L; G, J | G, J |

Using the Alphabet in pictures method, problem sounds were identified in the pronunciation of each examined child. Most do not pronounce, or substitute the sound R, S, Ş. Children do not pronounce the Ṭ sounds; Ci, R; Ş, S, Z, F. Some children distort the pronunciation of the sounds C, G, D, R, H, Others change the place of the sound in the word. Afterwards, the children were asked to make up a story with a picture from the Picture Alphabet. All six examined children narrated using short sentences, with distortions of sounds and abundant agrammatism (impossibility of grammatical agreement in gender, number, case). The sentences focus on naming what he sees in the picture.

Importantly, all children detected by screening have a multitude of symptoms, already listed, that confirm dysarthria disorder.

Results on methods for assessing mental processes: memory and thinking

- *Visual memory and auditory memory assessment tests*
- Visual memory evaluation test. Purpose: assessment of memory processes: fixation, retention, updating

- Auditory memory assessment test (digits): Purpose: assessment of auditory memory

Visual memory test results.

The children were shown cards on which familiar objects were drawn. From one object to 10 was drawn on the cards. The assessment was carried out individually.

Here's how preschoolers with dysarthria (PD) and typically developing preschoolers (TP) scored on this sample.

Table 2. *Preschoolers' scores on the Visual Memory test*

| | 1st Presch | 2 Presch | 3 Presch | 4 Presch | 5 Presch | 6 Presch | Average per group |
|----|---------------|-------------|-------------|-------------|-------------|-------------|-------------------------|
| TP | 9 | 8 | 10 | 7 | 8 | 9 | 8.5 |
| PD | 5 | 4 | 4 | 3 | 3 | 4 | 3.8 |

Preschoolers with Dysarthria had difficulty naming the object drawn on the picture for several reasons. Some did not recognize the object, although they were ordinary, everyday objects, and others pronounced the name incorrectly; and another cause was that they did not memorize drawn objects. On the cards with a smaller number of pictures, the preschoolers memorized the objects visually and presented them verbally, but with the increase in the number of drawn pictures, the reproduction difficulties were increasing. The total number of objects on the card shown, reproduced by preschoolers with dysarthria was 5 (preschooler with no. 1), among preschoolers with typical development, 3 children stood out, naming 9 and 10 images.

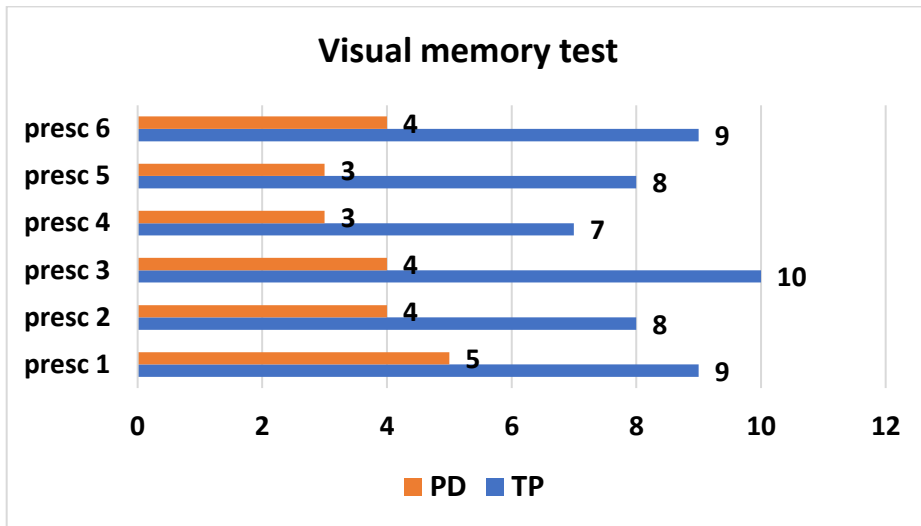


Figure 1. *Preschoolers' scores on the Visual Memory test*

The figure illustrates very clearly the differences between the results of preschoolers with dysarthria and preschoolers with typical development. The gap between the results is obvious. PDs named a maximum of 5 images, and TPs named 10 images, which tells about the level of visual memory.

Results of the auditory memory evaluation test (figures)

Children were individually and orally presented with a string of numbers starting with 2 to 8 digits. The child listened to them, tried to memorize them and then had to reproduce the memorized numbers.

The reproduction of the string of numbers was very diverse.

Table 3. *Preschoolers' scores on the Auditory Memory test*

| | Presch 1 | Presch 2 | Presch 3 | Presch 4 | Presch 5 | Presch 6 | Average per group |
|----|----------|----------|----------|----------|----------|----------|-------------------|
| TP | 8 | 7 | 8 | 8 | 8 | 7 | 7.7 |
| PD | 4 | 5 | 4 | 4 | 5 | 6 | 4.7 |

Again, we have a visible difference between the preschool groups. Intragroup differences are not essential.

The average of the results between the two groups of preschoolers is impressive, M-TP = 7.7 points, and M PD= 4.7 points - a difference of 3 points. There is a gap between the maximum and minimum score: from 8 numbers maximum, obtained by those with typical development and 4 numbers named by preschoolers with dysarthria. Next, in figure 2, we show the difference between the two groups of preschoolers.

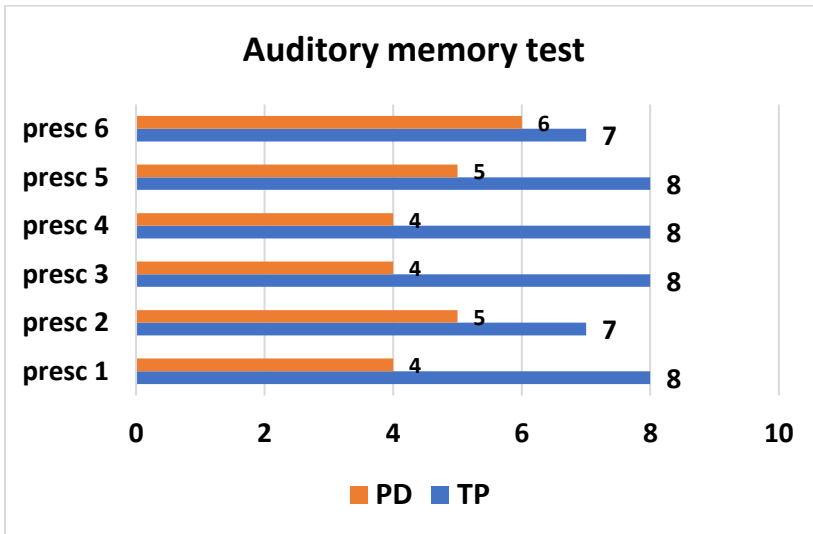


Figure 2. Auditory Memory, TP and PD, test results

The difference in the average results for preschoolers with typical development and preschoolers with dysarthria, in the Visual Memory and Auditory Memory methods, is illustrated in *Figure 3*.

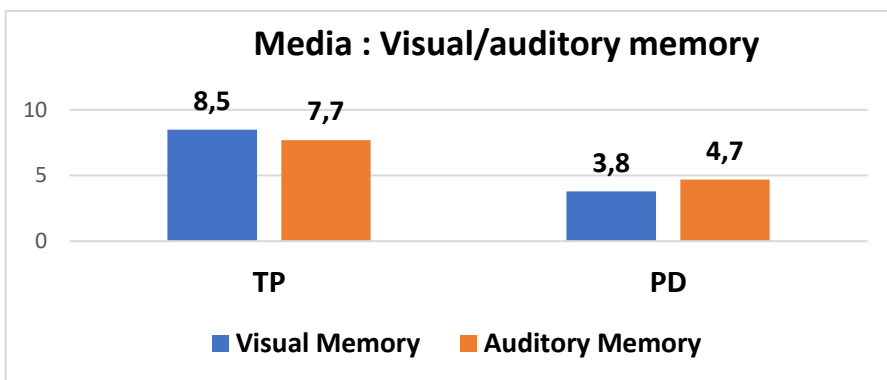


Figure 3. Mean results in Visual Memory and Auditory Memory methods, PD/TP

Obviously, the results are informative, they show us what we have to do to develop preschoolers with dysarthria, primarily in order to overcome, improve the language disorder and develop other mental processes such as auditory and visual memory, without which it is difficult to have results in language.

Results in Methods of assessment of thinking

Thinking was evaluated from the perspective of Conservation of Quantity, the ability to abstract, the ability to generalize.

To begin with, we present the children's Results for the Conservation of Quantity subtest.

This subsample contains 3 items where we use red square tokens and blue round tokens. We assessed preschoolers individually. We received the results shown in the table below.

Table 4. *Results on subsample Conservation of Quantity*

| | PD | | | | TP | | | |
|----------------------------|-----------------------------|---|---|----------|-----------------------------|---|---|----------|
| preschoolers / items | Conservation of Quantity | | | score | Conservation of Quantity | | | score |
| | a | b | c | | a | b | c | |
| 1 | + | | + | 2 | + | + | + | 3 |
| 2 | - | + | - | 1 | + | + | + | 3 |
| 3 | + | + | | 2 | + | + | + | 3 |
| 4 | | + | + | 2 | + | + | + | 3 |
| 5 | + | | + | 2 | + | + | + | 3 |
| 6 | | | + | 1 | + | + | + | 3 |

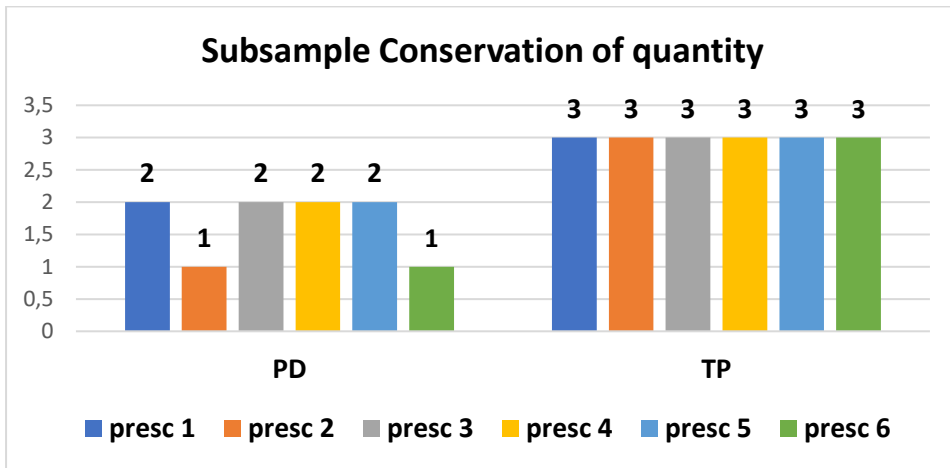


Figure 4. Results of the Conservation of Quantity subsample

Children's results on Capacity of abstraction subtest

The subsample also contains 3 items. It is carried out individually. The condition is for the children to group the figures according to criteria – from one criterion to three criteria (shape, color, size).

Table 5. Results on Abstraction capacity subtest

| | PD | | | score | TP | | | score |
|----------------------|----------------------|---|---|-------|-------------------------|---|---|-------|
| | Abstraction capacity | | | | Abstraction capacity -A | | | |
| Preschooler s/ items | a | b | c | | a | b | c | |
| 1 | + | | + | 2 | + | + | + | 3 |
| 2 | + | + | | 2 | + | + | | 2 |
| 3 | + | | | 1 | + | + | + | 3 |
| 4 | + | + | + | 3 | + | + | + | 3 |
| 5 | + | | | 1 | + | | | 1 |
| 6 | + | | + | 2 | + | + | + | 3 |

The subsample was performed with several difficulties, especially observed in preschoolers with dysarthria. Item 3 also caused impediments in preschoolers with typical development, but they were insignificant.

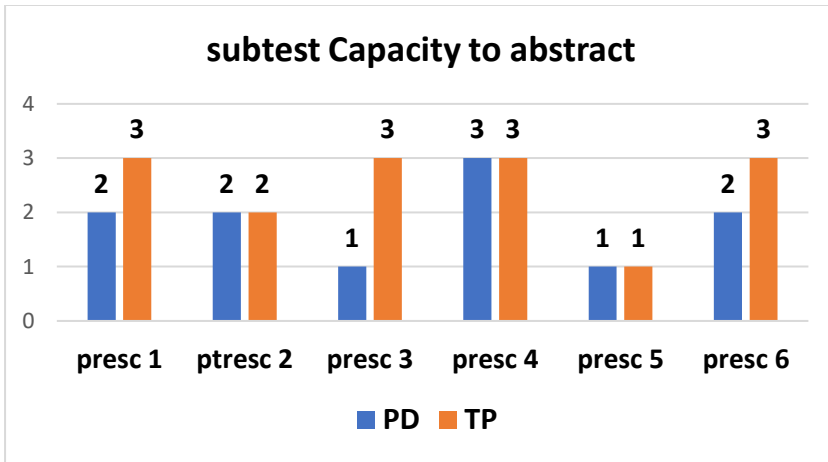


Figure 5. Results of the abstraction capacity subtest

We continue with the presentation of the data for the generalization subsample, for both categories of preschoolers: PD and TP.

Table 6. Results for the Generalization Capacity subtest, TP

| Preschoolers/ items | Generalization Capacity -G; TP | | | | | | | | | score |
|------------------------|--------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | a | b | c | d | e | f | g | h | i | |
| 1 | - | + | + | + | + | - | + | + | + | 7 |
| 2 | + | + | + | + | + | + | - | + | + | 8 |
| 3 | + | + | + | + | + | + | + | + | + | 9 |
| 4 | + | + | + | + | + | + | - | + | + | 8 |
| 5 | - | - | + | + | - | + | + | + | + | 7 |
| 6 | - | + | + | + | - | + | + | + | + | 7 |
| Total score | 3 | 5 | 6 | 6 | 4 | 5 | 4 | 6 | 6 | |

Preschoolers with PD succeeded on most items. This proves that they have well-developed generalization ability. Generalization is an operation of thinking, and thinking according to Vygotsky and Piaget, is closely related to language. Results of 7 points and above place them on the high score line.

Table 7. Results of the subsample Generalization ability, PD

| Preschoolers/ items | Generalization Capacity -G; PD | | | | | | | | | score |
|------------------------|--------------------------------|---|---|---|---|---|---|---|---|-------|
| | a | b | c | d | e | f | g | h | i | |
| 1 | | + | | | + | | + | | + | 4 |
| 2 | + | + | | | | + | | + | | 4 |
| 3 | + | | | + | | + | + | | + | 5 |
| 4 | + | | + | | + | | | + | | 4 |
| 5 | | | | + | | + | + | | + | 4 |
| 6 | | + | | + | | + | | | + | 4 |
| Total score | 3 | 3 | 1 | 3 | 2 | 4 | 3 | 2 | 4 | |

Preschoolers with dysarthria demonstrate average generalization ability.

If we analyze from the perspective of the complexity of the items, we state that the item "a", "e", "g" was complicated for both categories of students, but the difference in results leans towards preschoolers with dysarthria.

We illustrate the results in terms of item scores for PD and TP.

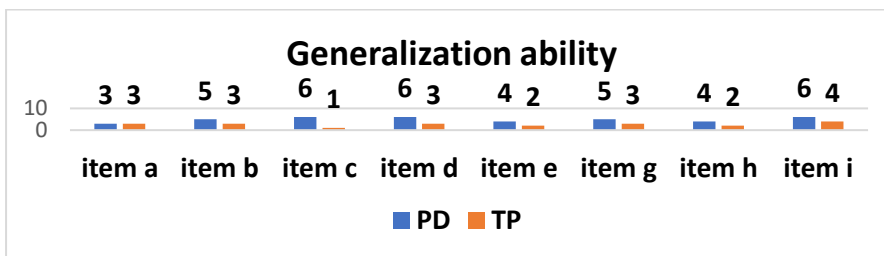


Figure 6. The difference between PD and TP results, on the items of Generalization Capacity subsample

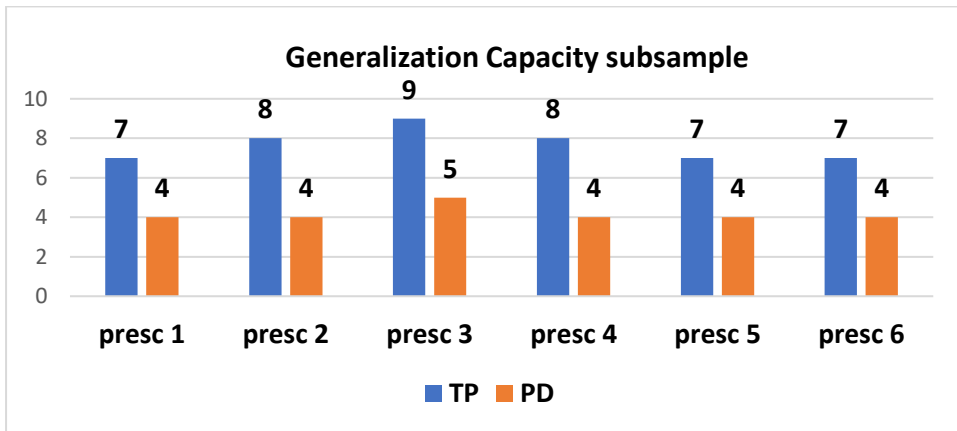


Figure 7. *Results on the Generalization Capacity subtest*

The analysis of preschoolers' scores for each item of the generalization subsample, then the comparison of preschoolers' results of both groups, allows us to conclude about the difficulty of solving tasks for preschoolers with dysarthria. Any deviation from the norm leads to difficulties on all dimensions of personality – cognition, emotionality, psychomotricity, which we identified in our study.

Final conclusions

A mini-investigation of the language disorder - dysarthria was carried out, on the theoretical and applied dimensions, with the aim of analyzing and synthesizing the scientific information related to dysarthria, on the one hand, checking through psychological and speech therapy methods the situation of language development and mental processes.

Dysarthria is a neurological language disorder, with a complicated etio-pathology, diverse in symptoms, the depth of neurological damage, the typological variety of forms of dysarthria, but also in the individual psychophysical peculiarities of the subject. It can be found alone but also in comorbidity with other pathologies (disabilities).

An experiment was carried out, which had a purpose, objective, hypothesis and a research methodology.

The study started by screening preschoolers with dysarthria among

preschoolers with various language disorders; and had a comparative nature, preschool subjects aged 5-6 years with dysarthria and with typical development.

The scores obtained in the tests administered revealed the way language is constituted and the organization of mental processes, memory and thinking in two categories of preschoolers, with dysarthria and mental development. The results confirmed the existing results in scientific research about the insufficiency of the development of mental processes assessed in preschoolers with dysarthria compared to preschoolers with typical development.

The results obtained and processed mathematically, helped us to achieve the goal and objective and confirmed the launched hypothesis.

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