

**Research Article**

# VB-MAPP: Opportunities for Differential Diagnosis of Verbal Skills and Social Interaction of Children with Autism and Hearing Disorders

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**ABSTRACT**

Research issue. Today, one of the most significant and debatable issues are ones related to the identification and study of the most high-quality and modern tools for differential diagnosis of verbal behavior disorders in children with autism and other developmental disorders. The relevance of this problem is determined by the need to solve the priority problem of the development of modern education – to improve its quality for children with disabilities for their successful socialization in a modern rapidly changing society. The importance of this issue is determined by the need to develop psychological and pedagogical correctional strategies based on the knowledge about the stages of normal mental development of children, core manifestations of autism as distorted mental development and knowledge of other developmental disorders. One of the newest developments in the field of diagnosis of verbal skills and social interaction of children with autism and other developmental disorders is M. Sandberg's VB-MAPP program. It was designed to determine the basic level of child's skills compared to normally developing peers. This program implies detailed assessment of child's skills, thorough selection of goals, planning of the learning process and monitoring the development of child's skills. Thus, the research objective is to study the experience of using the program for assessing verbal skills and social interaction in children with autism and other developmental disorders (VB-MAPP) and to experimentally identify the differential signs of verbal behavior disorders in children with autism and hearing impairments. The importance of the differential diagnosis is determined by the fact that children with autistic manifestations reasonably constitute a high-risk group, so the emphasis should be put precisely on early diagnosis aimed at differentiating verbal disorders and social interaction from other disorders in children with autism. Research methods: theoretical methods of constructive and functional analysis of the research subject based on the study of modern research. As empirical methods, we used a functional analysis of subtests of M. Sandberg's program "Assessment of verbal skills and social interaction for children with autism and other developmental disorders". The study involved 6 preschoolers with autism and hearing disorders. Conclusions and recommendations. The research results allow us to conclude that domestic pedagogy and psychology currently face the acute problem of diagnosis and assessment of functional skills of children with developmental disorders. Its relevance is determined by the need to develop individual correctional and educational program for each child that would improve their socialization, increase the level of social adaptation, development and effective learning. The development of such programs is possible only with the presence of accurate data on the level of the development of children, which may be collected with the use of special assessment methods (such as -VB-MAPP) developed on the basis of the methods of Applied Behavior Analysis, which represents an effective approach for developing skills in children with autism and other developmental disorders. In the course of the research, we have conducted an experiment which helped to identify differential communicative features of children with autism and hearing impairments and carried out a comparative analysis to determine effective methods of further correctional work. The results of the research can be used for the development of adapted basic educational programs for organizations teaching children with autism, hearing impairments and other developmental disorders within the framework of both special and inclusive education, individual educational programs, and implementation of comparative studies within this problem field.

**Keywords:** applied behavior analysis (ABA), functional analysis, VB-MAPP, communication, verbal skills, social interaction, hearing disorders, autism, autism spectrum disorders.

**INTRODUCTION**

The relevance of the research is determined by several factors. On the one hand, it is determined by the controversial situation in modern Russia associated with the need for a deeper and more comprehensive study of autism spectrum disorders

since the country faces a trend of the increase in the number of children from this category. On the other hand, it is determined by the unresolved issue of an integrated approach to the differential diagnosis of such manifestations – and especially their consequences, such as impaired communication,

socialization, peculiar behavior – which are different from similar states in children with other developmental disorders. Moreover, the importance of this issue is determined by the need to solve the priority tasks of the development of Russian education [1], i.e. to improve the quality of education for children with disabilities in order to ensure their successful socialization through the development of adapted correctional work programs based on the results of differential diagnosis built on the knowledge of the stages of normal mental development of children, manifestations of autism as a distorted mental development and knowledge of the characteristics of other developmental disorders [2-4]. These statements are supported by the opinions of Russian scientists about insufficient diagnosis of childhood autism in Russia (in comparison with European countries and the USA), as well as about insufficient consistency of diagnostic criteria presented in ICD-10, DSM-IV-TR, DSM-5 [5]. These international diagnostic systems have three main sets of diagnostic criteria for development and behavior: deterioration of social interaction, deterioration of sociability and imagination, significant decrease of interests and activity. Russian science uses the ICD-10 classification which contains no such diagnosis as "autism spectrum disorder". All autism spectrum disorders are included in the group called "general developmental disorders". ICD-11 version of 2018, which has not yet been implemented into practice, introduces the diagnosis of "autism spectrum disorder", and all diagnostic criteria are divided into subtypes indicating the presence / absence of an intellectual disorder and a person's ability to use "functional language" (English functional language; oral or written). It became possible thanks to an agreement reached between the World Health Organization (WHO) and the US National Institute of Mental Health. In DSM-5, all autism spectrum disorders are divided into two main groups: lack of social communication and social interaction, and limited, repetitive patterns of behavior, interests, or activities. The analysis of domestic diagnostic techniques showed that they are based on different concepts and approaches: neuropsychological, psycholinguistic, psychoanalytic, etc., which indicates that they have a narrowly focused nature. In foreign countries, for practical work with children with autism they effectively use diagnostic methods based on the behavioral approach. These include functional analysis and assessment of several areas of the development of a child – not only those with autism, but also with other developmental disorders, which makes it possible to simplify and increase the efficiency of the diagnostic procedure, identify differential signs and develop complex individual correctional work programs [6]. Recently, foreign diagnostic techniques (programs) developed within the paradigm of applied behavior

analysis are gaining more and more popularity. They are based on the data from the studies carried out within the framework of this approach.

One of the most popular methods widely used in foreign countries in working with children with developmental disorders (including autism spectrum disorders) is the Assessment of Basic Language and Learning Skills (ABLLS-R) developed by James W. Partington and Mark L. Sundberg [7]. It is aimed at determining the deficit of verbal skills and skills necessary for education and contains a list of criteria for assessing skills in 25 areas of development corresponding to the repertoire of a typically developing 8-year-old child. An important feature of ABLLS-R is that this test is aimed at implementing three interrelated goals: determining speaking, language and learning skills necessary for further education and development of a child; drawing up an individual development program based on the test results; determination of the effectiveness of child's education progress and assessment of the dynamics of his development through repeated testing. This is one of the most detailed tests for assessment of children's skills which allows determining in detail the psychological and pedagogical profile of a child before drawing up individual development program and identifying child's capabilities for further education.

The next common diagnostic technique is called PEAK (Promoting the Emergence of Advanced Knowledge); it was developed by M.R. Dixon *et al.* [8]. It is a system that includes a skills assessment tool and an intervention program for solving the problem of verbal and cognitive deficits in children with autism and developmental disorders [9]. Each program describes goals, materials, and typical incentives, as well as instructions for using the programs and collecting data. The technique consists of 4 training modules. Each separate module represents a system for assessing the presence or absence of 184 skills which act as a foundation for verbal behavior. They contain various training methods and combine traditional Skinner teaching techniques with post-Skinner methods. According to D.D. Reed and J.K. Luiselli [10], the limitation of this diagnostic technique is associated with the fact that, focusing solely on Skinner's verbal operands, these protocols ignore hundreds of studies on how a language develops through derived relational responses and corresponding transformations of stimulus functions [10]. The analysis of modern studies conducted by M.R. Dixon *et al.* [8] using PEAK assessment system shows that PEAK-DT can be applied based on student's current level of development, regardless of chronological age; applied analysis methods are effective in working with children with autism. Based on the analysis of the research results, we should note that PEAK is effective not only for assessing skills, but also as a guide for developing programs

with proven reliability and validity [11]. VB-MAPP program, developed by M. Sundberg, is one of the most widely used tools in Russian and foreign scientific practice for diagnosing speaking skills and social interaction of children with autism and other developmental disorders compared to normally developing peers. The results of the assessment make it possible to formulate the goals of an individual teaching program and a speech training program. The analysis of studies which present the results of examination of children with autism based on the VB-MAPP methodology showed that this program allows to effectively assess children's skills, carefully choose goals, plan the learning process and monitor the development of their skills [12, 13]. However, theoretical analysis of modern scientific studies on the differential diagnosis of speaking skills and social interaction in children with autism and other developmental disorders has shown that this issue is still not sufficiently studied. The solution to this question implies the purpose of the research – to experimentally identify the differential signs of verbal behavior disorders in children with autism and hearing disorders. The importance of studying and clarifying differentiated signs is determined by the fact that children with autistic manifestations reasonably constitute a high-risk group, which is why the emphasis should be placed precisely on early diagnosis aimed at differentiating autism symptoms from other disorders, including hearing impairments.

## RESEARCH METHODS

The research involved the following methods: theoretical methods (analysis of modern studies, synthesis and generalization of the results); empirical methods (parental questionnaire; diagnostics with the use of the VB-MAPP technique which includes testing using the subtest method; observation including the one limited in time);

ascertaining experiment which includes methods of mathematical statistics and graphical representation of the results).

The experimental base of the research was represented by a preschool department of the State budgetary educational institution "Kazan boarding school named after E.G. Lastochkina for children with disabilities" and the Municipal budgetary preschool educational institution "Kindergarten No. 149 of the compensating type" of the Moscow district of Kazan.

Assessment of children's verbal skills included 170 measurable educational and verbal milestones of development, which are conventionally distributed in the methodology among three age levels (0-18 months, 18-30 months, 30-48 months). The following skills were diagnosed: mand, tact, echo, intraverbal skills, listening skills, motoric imitation, onomatopoeia, reading written words, rewriting of text, writing down the words heard, social skills and social game, visual perception, group behavior, linguistics. Testing of skills was carried out in the order in which they are specified in the headings of the test. Based on the results of the assessment of each developmental milestone, the VB-MAPP "Assessment of the developmental milestones" protocol form was filled in, which then, having determined the current developmental milestone, allowed to set an individual intervention program in a more precise direction.

## RESULTS

The research involved two respondents. The first respondent was a 6 year 9 month old boy, his diagnosis is bilateral sensorineural hearing loss of a fourth degree. The child was born from II pregnancy and II birth. Pregnancy and childbirth developed well. Both parents of the child are deaf.

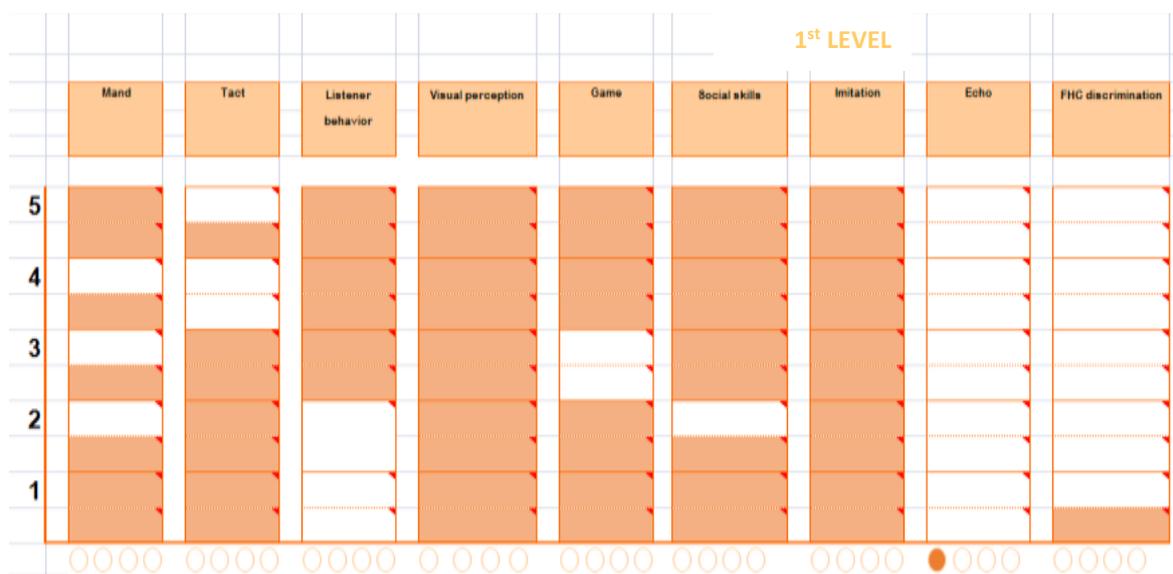
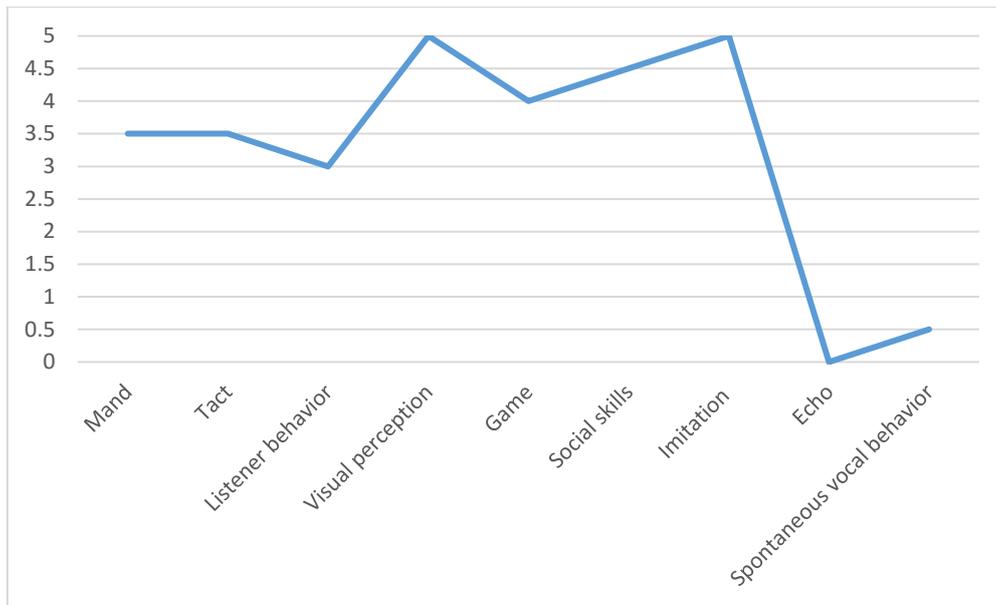


Fig.1: The results of the formation of basic verbal, educational and social skills at the 1st level in a 6-year-old boy



**Fig.2: Assessment of the milestones of the development of a 6-year-old boy at the 1st level**

The examination showed that the "Echo" skill is not formed.

Assessment of the "Mand" skill revealed that the child makes various requests using the sign language.

Examination of the "Tact" skill revealed that a child can name 8 different objects orally only after instructions, dactylating the presented word. Spontaneously, without any prompts, the child uses only sign language.

While examining the "Listener behavior" skill, the child was able to correctly select an object in a set of four items for 20 different objects or pictures only after simultaneous instructions given verbally and in a sign language.

Assessment of the "Visual perception" skill showed that the respondent accompanies a moving stimulus for 2 seconds, can do a "tweezers grip", examines

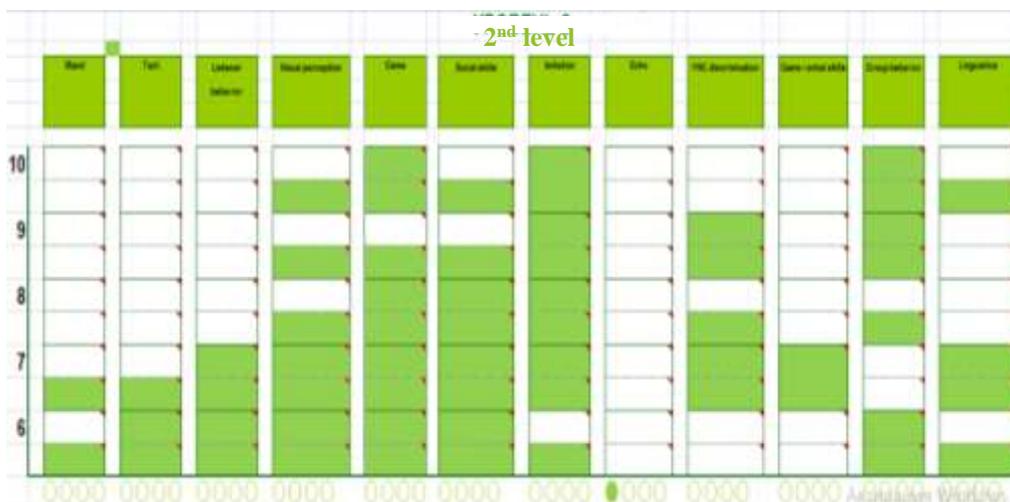
and focuses on the toy for 30 seconds, can build a tower of 3 cubes and put the figures into different containers, matches 10 identical items.

Examination of the "Game" skill showed that the child can independently play with a toy or play outdoor games for 2 minutes.

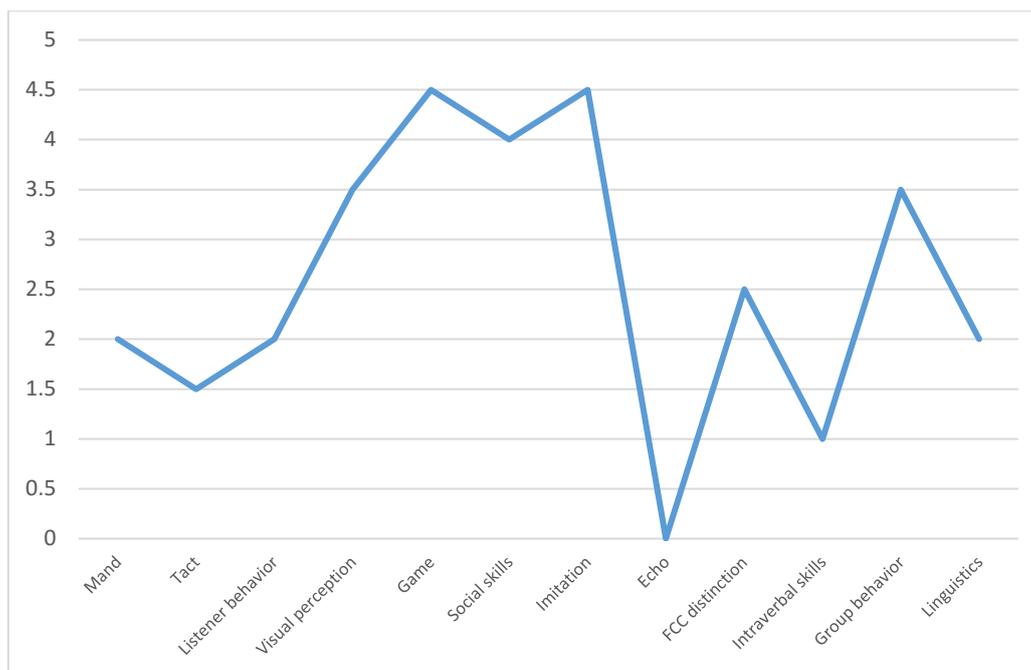
Assessment of social skill showed that the child follows the movements of the eyes of people nearby, spontaneously looks at other children, plays along with them for 2 minutes, follows their peers and spontaneously imitates their actions.

Examination of the "Imitation" skill revealed that the child imitates the movements of gross and fine motor skills, movements with objects, spontaneously imitates the movements of other people.

During the observation of the "Spontaneous vocal behavior" skill it was revealed that the child can make 2 different sounds within 1 hour.



**Fig.3: The results of the formation of basic verbal, learning and social skills at the 2nd level in a 6-year-old boy**



**Fig.4: Assessment of milestones in the development of a 6-year-old boy at the 2nd level**

Examination of the "Mand" skill showed that the child can ask for an item without prompting and ask other people for assistance.

According to the results of the "Tact" skill examination, it was found that the boy can name the item after the question "What is this?" He can summarize the names for 3 types of items.

Analysis of the diagnostic results of the skill "Listener Behavior" revealed that the child can select the correct item from a set of 6 objects and is able to summarize 3 different items when choosing from 8. The study of the "Visual perception" skill showed that the respondent can match the same pictures in a set of 8 pictures, sort objects by color, shape, and match non-identical pictures in a set of 10.

Examination of the "Game" skill showed that the child uses an item or a toy in accordance with their functions. He plays creatively with everyday items and can independently play on the playground.

Observation of social skills revealed that the child uses a sign language for asking his peers to do something; he also plays social games with them.

Examination of the "Imitation" skill showed that the boy imitates movements after the phrase "Do it like this", and also imitates functional skills in a natural environment.

Assessment of the skill "Function, characteristics and categories distinction" revealed that the child can choose 5 different types of food from a set of 5 inedible objects, can show the object in the book after a question in sign language that contains a

noun and a verb. In intraverbal skills, the child was able to answer the question "What is your name?".

Observation of the "Behavior in a group" skill showed that the respondent is able to sit while eating and work in a small group of children for 10 minutes without any signs of undesirable behavior. Examination of the "Linguistics" skill showed that adults do not always understand the articulation of the child, but he can pronounce 5 names and can be understood by adults. His total vocabulary consists of 200 words.

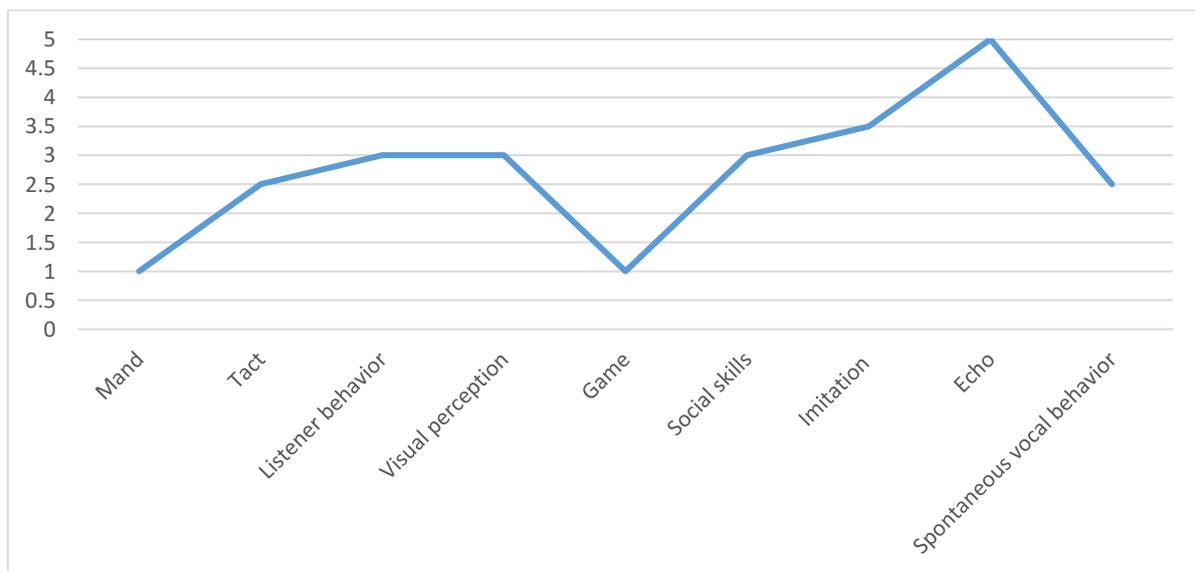
During the analysis of the research results and the assessment of "developmental milestones", it was revealed that the level of development of the respondent's verbal, learning and social skills corresponds to the first level. On the first level, the respondent scored 28.5 points out of 45 possible, at level 2 it was 59 out of 105 possible. Most skills are formed at the level of a 0-18 month old normotypic baby. The strongest skills were "Visual perception", "Game", "Imitation", "Social skills" and "Behavior in a group". The skills "Mand", "Tact", "Listener behavior", "Echo", "FCC distinction", "Intraverbal skills" and "Linguistics" turned out to be weaker.

This child needs an intensive correctional program to develop verbal behavior. Training should take place on a daily basis – both in a structured (pre-planned) and in a free (in a natural environment) format.

The second respondent was a 6 year 11 months old boy; the diagnosis is autism spectrum disorder.



**Fig.5: The results of the formation of basic verbal, learning and social skills at the 1 level in a 6-year-old boy**



**Fig.6: Assessment of milestones in the development of a 6-year-old boy at the 1 level**

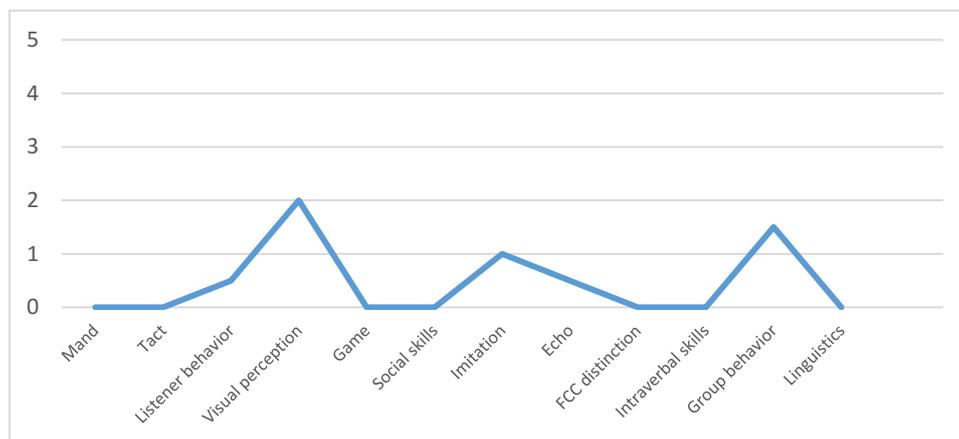
Assessment of the skills "Mand" and "Tact" showed that the respondent can make 3 requests without prompting and name 5 objects. During the diagnosis of the skill "Listener behavior" it was revealed that the child distinguishes the subject when choosing from 4 items and draws attention to the speaker. Assessment of the skill "Visual Perception" showed that the respondent can match 6 identical objects, sorts items by shapes and colors for 5 different shapes and colors. During the assessment of the "Game" skill, it was noted that the boy manipulates objects for 30

seconds and plays with 3 different items for 30 minutes.

The results of the social skill assessment revealed that the child uses eye contact as a mand reaction, he can show what he wants and comes into contact with peers. Diagnosis of the "Imitation" skill revealed that the boy can imitate 15 movements of various kinds. Observation of the "Spontaneous vocal behavior" skill showed that the boy can make 10 different sounds with different intonations.



**Fig.7: The results of the formation of basic verbal, learning and social skills at the 2 level in a 6-year-old boy**



**Fig.8: Assessment of milestones in the development of a 6-year-old boy at the 2nd level**

Based on the results of the assessment of the child's developmental milestones at the second level, it was revealed that such skills as "Mand", "Tact", "Game", "Social skills", "FCC distinction", "Intraverbal skills", "Linguistics" are not developed well enough.

During the examination of the skill "Listener behavior", it was found that the child can choose the right object from a set of 6 items.

Assessment of the "Visual perception" skill: the respondent compares identical pictures from a set of 6 pictures, sorts items by shapes and colors for 5 different shapes and colors, compares identical objects or pictures from a set of 8 items, including 6 similar stimuli. Diagnosis of the "Imitation" skill revealed that the child imitates 5 movements that require the selection of a specific item and 10 motor actions.

According to the results of the EESA test, the child scored 40 points.

Observation of the "Behavior in a group" skill showed that the child can sit with a food without

unwanted behavior. He also sets aside the subjects he studied and approaches the teacher after 2 verbal clues.

During the analysis of the research results and the assessment of "developmental milestones", it was revealed that the level of development of the respondent's verbal, learning and social skills corresponds to the first level. According to the results of the assessment, the child received 25 points out of 45 possible (for an 18 months old child), 31.5 out of 105 possible (for 30 months old child), and out of 170 possible (for the child 48 months).

The child requires an intensive program of behavioral intervention. Training should take place on a daily basis – both in a structured (pre-planned) and in a free (in a natural environment) format. Most skills are formed at the level of a 0–18 month old normotypic baby. The most well-formed skills are "Visual Perception", "Listener behavior", "Echo", "Imitation". The skills "Mand" and "Game" turned out to be weaker.

Based on the results of the survey, we identified the strengths and weaknesses of the comprehensive development of the child with autism spectrum disorder and hearing disorder.

A child with an autism spectrum disorder has the following strengths:

1. He successfully compares and matches identical objects and pictures, uses tweezers to grip, focuses on the item, can build a tower of cubes, lay out objects in containers ("Visual Perception" skill).
2. There is a large number of vocalizations, the child can easily repeat the sound and words according to the instructions of an adult ("Echo" skill).
3. The respondent imitates movements of gross and fine motor skills, actions with objects. He can spontaneously imitate the actions of other people. ("Imitation" skill).

Strengths of a hearing impaired child:

1. He successfully compares and matches identical objects and can also find identical items. He can sort objects by color and shape, compare two-dimensional and three-dimensional objects ("Visual Perception" skill).
2. The child has a motivation to receive the missing item, and his behavior is controlled by this motivation during games with the objects. He understands that certain objects and toys have a specific functional purpose, and he can use objects in a variety of ways quite creatively. ("Game" skill).
3. The respondent takes the initiative to physically interact with his peers; he may turn to them with a request and can also play with them for a long period of time (social skills).
4. He successfully repeats the movements of gross and fine motor skills, actions with objects. He spontaneously imitates functional skills in a natural environment ("Imitation" skill).

Weaknesses of a child with ASD:

1. He rarely asks for anything, or does not do it at all; his requests consist of one word ("Mand" skill).
2. Being in a new environment, he does not look around and does not study toys. Physical activity itself does not seem as an encouragement for the child. Exercises based on a causal relationship do not seem attractive for the child ("Game" skill).
3. During the lesson, the child does not move from one exercise to another, cannot sit in a small group of children without any undesirable behavior for 5 minutes, does not pay attention to teacher or material ("Behavior in the group" skill).

Weaknesses of the hearing impaired child:

1. The child practically does not vocalize. He can hardly repeat the words after the instructions of an adult ("Echo" skill).
2. The child practically does not make any sounds ("Spontaneous vocal behavior" skill).
3. The respondent was unable to complete phrases of any kind and answer questions containing the words "What, who, and where?" (Interverbal skills).

4. It is difficult for adults to understand the words that the child says. As a listener, he does not understand the words, does not pronounce statements containing 2 or more words ("Linguistics" skill).

## DISCUSSION

The study of psychological and pedagogical sources allows us to state the absence of special research on the issue of identification of differential signs of verbal behavior disorders in children with autism and hearing impairments using the program for assessing verbal skills and social interaction in children with autism and other developmental disorders (VB-MAPP) in practice. However, the importance and significance of differential diagnosis is emphasized in the studies of O.S. Nikolskaya, E.R. Baenskaya, M.M. Libling [14], V.E. Kagan [15], S. Dovbnya *et al.* [16], M.L. Semenovich *et al.* [6].

Issues concerning psychological and pedagogical examination of children with hearing impairments are explored in the studies of A.A. Wenger *et al.* [17], N.D. Shmatko and T.V. Pelymskaya [18], I.A. Shapoval [19], I.Y. Levchenko, S.D. Zabramnaya and T.A. Dobrovolskaya [20], O.N. Usanova [21], L.P. Grigoryeva [22]. There are no modern research aimed at studying verbal skills and social behavior based on applied behavior analysis.

The results of the study of children with autism based on the VB-MAPP methodology and appropriate teaching methods are found in the studies of M.T. Brodhead *et al.* [12], A. Carnett and E.T. Ingvarsson [23], B.P. Contreras and A.M. Betz [24], M.R. Dixon *et al.* [8]; C. Gevarter *et al.* [25], A.N. McKeel *et al.* [9], M.E. Kelley *et al.* [26]; A.N. Kisamore, A.M. Karsten and C.C. Mann [27]; T. Kodak *et al.* [28]; L.L. Mason, D. Davis and A. Andrews [29]; C.A. Wymer *et al.* [30]. Modern studies describing the results of the testing of children with hearing impairments using the VB-MAPP technique are not presented.

However, the importance and significance of the differential diagnosis is considered in the studies of O.S. Nikolskaya, E.R. Baenskaya and M.M. Libling [14], V.E. Kagan [15], S. Dovbnya *et al.* [16], M.L. Semenovich *et al.* [6].

## CONCLUSION

We have established that the program for assessing verbal skills and social interaction in children with autism and other developmental disorders (VB-MAPP) allows to identify the differential signs of verbal behavior disorders in children with autism and hearing impairments, which will help specialists working in the inclusive education field (where the basic principle is an individual and differentiated approach) to develop for each child with developmental disorder individual correctional and educational program aimed at successful

socialization and effective education taking into account the violations identified for this nosology. We have assumed that the effectiveness of such programs will be high, since the method proposed for differential diagnosis allows to identify and compare the characteristics of children with various impairments, including autism and hearing impairments. It also allows to determine which skills the child will need to acquire and which "barriers" will hinder his successful learning and socialization. Based on a comparative analysis, it will be possible to identify effective methods for further corrective work.

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