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Conscious Communication Skills Formation in Children with Autism Spectrum Disorders (Initial Period)

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Abstract: *Despite the number of researches made on the problem of developing communication skills in children with autism spectrum disorders (hereinafter ASD), there are still many issues in this area covered insufficiently. Significant difficulties appear at the first stage of developing communication skills, when the children with ASD have not yet formed attention to other people, there is no contact with them, and they may not even recognize their relatives. Under such conditions, it is difficult for parents to care for and to interact with such children. Other experts are also often frightened of them. Without the proper experience of interaction, they do not have any long-term vision of the process and dynamics of developing their communication skills.*

The purpose of our study was to create and test a step-by-step method of forming initial conscious communication skills in children with ASD, as well as to identify the dynamics and guidelines that indicate their prerequisites for this skill and readiness for the productive communication.

By implementing the methodology in practice, we identified and described eight groups of markers of the transition of children with ASD from one stage of work to another. Such guidelines can help special educators determine the effectiveness of the learning process as the duration of work with the child during this period can be extended. The duration of the formation of initial communication skills in children with ASD varies and depends on several factors: the child's age, regularity of classes, active parental involvement, levels of intellectual delay, and behavioral disorders.

With the proposed method, the skill of communication is formed holistically, with the inclusion of all the elements that are inherent in it:

- *emotional arousal as a reaction to the object of communication;*
- *contact attention;*
- *imitation of communicative forms of behavior demonstrated by others;*
- *requests and orders to meet ego needs;*
- *knowledge sharing.*

Keywords: *autism spectrum disorders (ASD), initial period of forming conscious communication skills, method of sensory integration, phenomenological approach, coordination movements.*

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1. Introduction

Autism spectrum disorder is a problem that confuses the mind and worries people who encounter it due to life circumstances (birth of a child in the family, living next to them as a family member, neighbor, or other cases) or professional needs (kindergartener, teacher, speech therapist, correctional teacher, psychologist). What worries people around these children most is the difficulty of communicating with them on verbal and nonverbal levels and the lack of understanding of how to learn to interact with them.

Significant difficulties in establishing social contact are characteristic of children with ASD. In general, according to the generally accepted definition given in the American Psychological Association 2013, this disorder is considered "a disorder of neurodevelopment, characterized by persistent disorders of social interaction and the presence of limited, repetitive patterns of behavior, interests or activities" (Mizhnarodna statystychna klasyfikatsiia khvorob ta sporidnenykh problem okhorony zdorovia Desiatyi perehliad, 2017).

One of the leading symptoms of ASD is a delay in communication skills development. By one year, these children have a noticeable lack of need to interact with others. They do not seek communication, do not lean towards the adult, and imitate their gestures and facial expressions, although, in some cases, situationally utter individual sounds and sound complexes (Sparling, 1991).

The scientists state (Stone et al., 1997) that the skill of communication in this category of children has several specific features. Most children with ASD use simple forms of behavior to communicate information, while children with typical development use speech as the primary means of communication, supplementing it with gestures and facial expressions. For example, if a child with ASD wants an object, they will pick it up or point to it without verbal speech (attracting an adult's attention through facial expressions, gestures, and more). In other situations, children with ASD may use gaze or unusual forms of verbalization without involving an adult in communication, while children with typical development will use speech to express their desires and involve an adult to achieve their goal.

Skrypnyk & Lozova (2020) state that in learning and upbringing, children with ASD develop certain types of expressions, interaction through requests, sharing of real or imaginary information, excitement, emotional experience, establishing and maintaining contact. However, they manifest themselves in their way, which is different from children with typical development. Requests come either from a third party (the boy, he) or in the

form of gestures and words that accompany similar or alike situations. Information is shared by naming real or imaginary objects, mainly in the present tense, repetitive phrases, descriptions of real or imaginary situations. Emotional experience in these children can cause a loud cry, self-aggression, and conscious refusal to do something. Establishing contact with them, in most cases, is reduced to echolalia. At the same time, such types of messages as order, infusion, and persuasion are not typical for them.

By the researches of Landa (2007), Adams (1998), Dewey et al. (2007), Dowd et al. (2012), Downey & Rapport (2012), developmental delay, fragmentation, and disproportionality of communication skills of children with ASD are associated with phonetic apraxia due to weakness of the kinesthetic factor and disintegrative disorder within the auditory and visual sensory systems. Their limited use of gesture support is associated with finger dyspraxia. As stated by the researchers (Baron-Cohen, 2002; Dowell et al., 2009), in this case, people with ASD may have the ability to communicate, although its development delays due to the presence of movement dysfunction.

Thus, impaired communication skills are a significant problem that inhibits the holistic development of children with ASD and their socialization and requires further study. While forming this skill, various disproportions arise caused by the disintegrative disorder within the sensory systems.

2. Sensory disorders as a reason for difficulties in developing communication skills in children with ASD: analytical review

Sensory disorders are the leading cause of specific difficulties that arise in developing communication skills in ASD cases. Thus, 92% of children with ASD have atypical sensory behavior (Green et al., 2016). People of different ages (from 7 months to 56 years) show a direct relationship between the severity of behavioral manifestations of ASD and the severity of sensory disorders (Ben-Sasson et al., 2009). As the adults with ASD say, the main symptoms that affect their worldview and life are atypical perception, fragmentary sensory information processing, and emotional regulation difficulties (Chamak et al., 2008). During life or at a particular stage of development, the same person with ASD may have several types of sensory abnormalities.

Given the soundness of the collected database, this type of symptom was introduced into the DSM-5 criteria (American Psychiatric Association, 2013). It consists of increased or decreased touch responsiveness or unusual interest in sensory aspects of the environment. In children with ASD, there are two main sensory models: hyporesponsiveness and hyperresponsiveness (Ausderau et al., 2014).

Such behavioral manifestations are determined following the sensory systems: proprioceptive, vestibular, visual, auditory, tactile, and olfactory (see Table 1) (Posar & Visconti, 2018).

Table 1 Features of hyperresponsiveness and hyporesponsiveness manifestation within the sensory systems in ASD

Sensory system	**Hyperresponsiveness**	**Hyporesponsiveness**
Proprioceptive	Difficulties in controlling one's body, awkwardness. Hypertension of arm or leg muscles, tiptoeing. Grinding teeth. Difficulties in mastering movement skills (too strongly or insufficiently opens/closes the water tap, doors, and more). Peculiarities of speech development.	Difficulties in keeping the posture for a long time. Leg and arm muscle hypotonia. Body jiggling. Difficulties in manipulation with the object (cannot throw and catch the ball). Difficulties in mastering jumps. Difficulties in mastering the articulation of speech sounds without special assistance.
Vestibular	Stress (fear) when using an elevator or stairs. In transport, the anxiety amplified during the movement. Refusal to ride roller skates, bicycles, scooters, and other transport.	Restlessness, constant need to be on the move. Rocking. Whirling around. An excessive need for rocking.
Visual	Irritability in bright light, excessive need for Panama or glasses on the sunny day. Avoiding toys that move quickly, flicker, or flash. The need to turn off the lights and hide in dark places.	Hanging on visual stimuli (soap bubbles, flashing toys, movies with the lights off). The need to throw objects and observe their movements. Waving their palms before their eyes.
Auditory	The fright of sharp, loud sounds and inability to switch to something else. Closing ears in the subway (in other transport). Protest when visiting noisy places (malls, children's rooms, and others).	The need to sing loudly, shout. Increased interest in musical instruments. The need to knock something and turn on the sound loudly on gadgets. The presence of speech delay.
Tactile	Avoidance of touch. Protest over dirty hands, finger painting, modelling. Changing clothes (especially when the season changes) and taking a bath or shower is a stressful event.	The need to play with tactile toys (thorns, slimes, kinetic sand). Licking hands and objects. The presence of a desire to get dirty. In the process of eating, tasting each component of the dish separately.

Olfactory	Anxiety when wearing washed clothes due to the smell of washing powder (respectively, when changing linen in the bedroom, after cleaning with chemicals). Protest against new and unknown tastes, fastidiousness in food. Agitation when someone nearby or the room itself has a pronounced odor.	The desire to smell perfumes or other objects, people who have a pronounced odor (such as coffee, cologne, aromatic oils). The presence of a desire to be in crowded places. No sense of smell or taste leads to putting both what is useful and harmful to the mouth.

Source: Author's own conception

We have identified the significant connections between hyperresponsive and stereotyped behavior, sensory search and ritual behavior, and no connections between hyporesponsiveness and specific behavioral manifestations of significant dependencies (Boyd et al., 2010).

There are two types of sensory integration dysfunction in children with ASD (Biel, 2015). The first one is a violation of the registration of sensory stimuli; the second is a violation of the modulation of sensory impulses. Violation of registration mainly affects visual and auditory stimuli, to a lesser extent — olfactory, gustatory, vestibular, proprioceptive and somatosensory stimuli. Children with ASD often ignore sounds, even those that seem significant to others. They do not react when someone is talking to them; do not focus on the environment and avoid looking into the eyes; they are not interested in the toy in general, but can pay attention to its small part and individual details around it (like a piece of thread on the carpet).

Another study (Przyrowski & Grzybowska, 2012) found that children with ASD experienced problems registering proprioceptive and somatosensory stimuli. Those with reduced sensitivity sometimes do not register pain impulses in themselves and others and therefore may injure (such as scratch) themselves or others without realizing it. Due to the difficulty of understanding the articulation of speech sounds, they may delay the formation of its phonetic components and language competence in general. Sometimes it can be manifested differently: with the slow development of lexical and grammatical components of speech, we observe the correct phonetic pronunciation of sounds.

Thus, we consider sensory disorders in children with ASD the reason for difficulties in mastering communication skills, which lead to uncoordinated participation of different sensory systems in this process, the disintegration of sensory stimuli into a single integral, harmoniously organized system of neural connections. In most children with ASD, the tactile factor is the weakest. This category of children has movement

dysfunction, which has a decisive influence on the quality of their mastering verbal means of communication and gestures.

3. Methods of formation of the communication skills in children with ASD

An analysis of ASD intervention techniques has shown that they include specific strategies for managing sensory behavior. In the context of sensory intervention, there is a distinction between sensory integration (child-centered) and sensory intervention (adult-centered) therapies.

Sensory integration therapies use play activities and enhanced sensory interactions to improve adaptive responses to sensory experiences. Due to movement activity, which activates the vestibular, proprioceptive, and somatosensory systems, these interventions aim to strengthen the ability to integrate sensory information, forcing the child to accept organized and adaptive behavior. The work helps to improve communication focus, social skills, movement planning, and perception (visual, auditory, tactile).

Sensory intervention is performed in specially equipped rooms. One-touch strategies (such as therapeutic balls or weight-bearing vests) help reduce the state of high agitation, which can take the form of anxiety, hyperactivity, and self-stimulating behavior (Case-Smith et al., 2015).

The analysis of these two strategies (Lane et al., 2014) has revealed that sensory integration has a more general positive therapeutic effect on forming purposeful activities, reducing stereotypes and rituals in behavior, improving self-care and social functions, and reducing the manifestations of sensory disorders. It can help develop communication skills in children with ASD. Conversely, studies of sensory interventions have shown only a narrowly focused positive effect reducing the negative manifestations of behavioral reactions in children with ASD.

The Denver model, effective for developing communication skills in children with ASD at an early age (from 12 to 48 months), is widespread (Olson & Offerman, 2021). It involves the implementation of an integrated approach to early behavioral intervention. This model includes a development curriculum based on a child's skills at a certain age. It also presents a set of training procedures used to develop these skills. Its main characteristics include:

1. naturalistic application of behavioral analytical strategy (application of social games and subject manipulations in order to stimulate communicative intent and gesture communication);

2. focus on the normative sequence of development of manipulative actions with objects; movements of the body and organs of articulation,

facial expressions and sound pronunciation, recognition of objects and their images by analogy, and more;

3. full participation of parents in the learning process (their presence in the classroom and further consolidation of existing knowledge and skills at home);

4. focus on interpersonal exchange and positive emotions (modeling and reinforcing positive behavior);

5. general classes of joint activities (manipulation with objects, games, selection of drawings by analogy);

6. forming speech and communication in a positive relationship (understanding simple instructions and repeated speech).

We have also developed the PROMPT (Tips for Restructuring Oral-Muscular Phonetic Objectives) technique to develop speech in children with ASD. It is based on the statement that touch is the primary sensory modality that can help for:

1. development, balancing, or restoration of control over the implementation of speech

2. creating a basis for the integration of sensory modalities in the development of expressive speech

3. strengthening social and emotional interaction and trust between the clinician and the client

The use of this model has had a positive effect on the formation of verbal means of communication in children with ASD (Rogers et al., 2006).

Thus, as a result of the analysis of different strategies for the formation of communication skills in children with ASD, we determined:

1. the practical impact of sensory integration therapy, which allows the maximum use of different sensory systems and ensures their coordinated participation in this process

2. the need for special training with a focus on tactile modality as the basis for the integration of senses arising in other modalities

3. taking into account the typical patterns of development of communication skills;

4. the importance of applying positive behavioral strategies that ensure interpersonal interaction

5. the productivity of an integrated approach involving different professionals in the learning process and the vital role of parents as participants

This study is aimed to develop a step-by-step method of forming the primary skill of conscious communication in children with ASD taking into account the aforementioned features. It provided the development of

readiness for conscious communication and the stimulation of this skill as an integrated function. We also conducted specially organized training to determine the effectiveness and specificity of applying this technique in practice.

4. Methods of the research: analytical review

Our method of forming conscious communication skills in children with ASD is based on the study of the normative development of children.

In particular, we are talking about the tactile-kinesthetic factor, the basis for the formation of speech function (because the pronunciation of phonemes stands on the idea of basic articulatory positions). The first ideas about articulatory positions appear in the process of breastfeeding (Olson & Offerman, 2021). Subsequently, the standard of the phoneme sounding (with the participation of the auditory sensory system) and the visual articulation image (with the participation of the visual sensory system) are fixed for each sensation of articulation. We consider the visual articulation image to provide feedback to a child in our work system. This component is significant in kinesthetic weakness and auditory perception disorders (Olson & Offerman, 2021).

With the normative development of children, when their perception of somatic space gets mature, they begin to use gestures, facial expressions, speech sounds, and sound complexes consciously. This idea can be considered the basis for forming the semantic space within which thought moves (McLeod, 2018).

The development of the child's somato-spatial representation occurs with the direct participation of the proprioceptive factor, which is maximally active in the child's activity, self-movement. Based on the awareness of one's own body and its parts, the core of the semantic field of human consciousness (the image of "I") forms, from which peripheral connections develop (Jana, 2010). Subsequently, these relationships continue to develop with intersensory participation (Houwen et al., 2016). In this case, in each child and adult, they acquire an individual focus depending on the leading factor of consciousness.

One of the crucial factors determining the difficulties of meaningful and purposeful use of means of communication by these children is the slow maturation rate of their self-awareness (Conde-Guzón et al., 2009; Lou & Changeux, 2017; Green et al., 2016; Kimberly et al., 2010). Therefore, developing the methodology for forming the first conscious communication skills, we consider that the beginning of its development is associated with the maturation of the "I" image.

The method of sensory integration, kinesiological and phenomenological approaches, and the theory of coordination movements are the basis of our method of forming the primary skill of conscious communication in children with ASD.

4.1 Method of sensory integration

The use of the *method of sensory integration* is the basis for the holistic development of a child with ASD. When developing the methodology, the stimulation of the work of organs and sensory management in the conditions of coordination of different sensory systems requires the implementation of two global directions:

1. the creation of special conditions that facilitate the reflection of surrounding objects in consciousness and productive interaction with them; adaptation of the environment to the needs of a child with dysfunction of sensory integration

2. the development of polysensory reproduction, which involves improving specific perceptual skills (visual, auditory, tactile); aggregation of data from different senses; formation of integrated use of skills

We paid particular attention to the formation of the synthesis of sensory systems. Under the condition of their joint activity, an objective order of permanent interrelations is created, which includes the following leading chains:

1. tactile – proprioceptive – vestibular – visual
2. tactile – auditory – visual
3. tactile – olfactory – visual (Ausderau et al., 2014; Ayres & Robbins, 2005; Case-Smith et al., 2015; Lane et al., 2014;).

4.2. Kinesiological approach

Considering *the kinesiological approach* (Borghi & Cimatti, 2010; Gomez-Pinilla, 2002; Rosenhahn et al., 2007), we assumed the possibility of developing a child's self-awareness through movement. An illness or another developmental problem in a child can be diagnosed as local or general hypo- or hypertonicity of the body muscles, which are only an external projection of the disorder. The definition of muscle tone in kinesiology reveals the balance (imbalance) of energies and intrachemical reactions in different body parts. In order to understand the movements of different parts of the body and hence the treatment, we used the elements of massage, stretching exercises, and more. We also considered the position presented in educational kinesiology (Ayres & Robbins, 2005). According to it, the use of exercises for different parts of the body stimulates the development of

intelligence, expands the understanding of the limits and potential of movements of different parts of the body, and the regulation of emotional and volitional qualities. In developing the methodology, we used these approaches to diagnose motor difficulties in the studied children at all the stages of the training process: in preparatory work for the formation of the skill of conscious communication and stimulating conscious speech.

4.3. Phenomenological approach

According to *the phenomenological approach* (Skrypnyk, 2010), the factor of sensory impressions is not the object itself but the movements of different parts of our body. In the process of conscious perception, there is a conscious movement (turning the head towards the location of the object, sound stimulus), and therefore it is associated with the awareness of self-movement. Self-movement and awareness of it as a means of perception are called "kinestheses" (Husserl, 1991). Moving while investigating the world, the body becomes its element, and the world – the fulcrum (location) of the body. When perceiving objects of the surrounding world, not one sensory system is involved, but the whole body. Given this, forming a sense of all parts of children's bodies and their self-movement is an essential prerequisite for forming their skill of conscious communication. Purposeful movement, performed independently by a child with ASD, we considered a landmark (marker), indicating the possibility of transition to more complex tasks.

4.4. Theory of coordination movements

In *the theory of coordination movements* (Bernshtein, 1990), each body movement, depending on its complexity and semantic content, is provided by a synthetic field of consciousness, represented by specific organs of our body and biochemical processes that ensure their interaction. Levels develop and function in a strict hierarchical sequence:

1. rubrospinal (A), which provides central regulation and adjustment of muscle tone in the process of performing movements of different levels of complexity;
2. thalamic-pyramidal (B), which forms rhythmic movements and automates movements of any complexity;
3. pyramidal-striatal (C), which provides the development and automation of spatially localized movements, as well as the plasticity of coordination manifestations;
4. parietal-premotor (D), due to which subject-oriented movements and the ability to transfer the scheme of action to another situation form;

5. cortical (E), which forms semantic and conditionally symbolic actions and motives, plans, and forecasts the probable situation, schematic and holistic vision.

The methodology for forming the primary conscious communication skills in children with ASD provides for the formation of the first four coordination movements and considers their hierarchy of development. Due to this, we defined a precise sequence of training offering the consistent application of a set of exercises:

1. with a passive level of performance – without purposeful participation of the child, when the teacher performs all movements of different parts of their body;

2. passive-active level of performance – with the partial participation of the child performing the movement when the teacher begins the movement of some part of their body, and the child continues it. Thus, the movement is performed at the beginning of its trajectory by the teacher and subject to adult control of the direction of its implementation following the goal;

3. involuntary – with a recollection of the experience of performing the movement in a similar situation;

4. arbitrary independent level of performance – when the child performs the movement independently following the goal with the conscious regulation of its trajectory.

5. Author's methodology of forming the primary conscious communication skills

Developing the method, we considered the presence of primary unconscious level of attitude to themselves in children with ASD at the beginning of rehabilitation training and the presence of disintegrative sensory disorders in them.

The implementation of training had three stages:

1. self-awareness
2. basic communication skills
3. skills of conscious communication (see Table 2).

Table 2 Characteristics of the stages of formation of conscious speech in children with ASD

Stage	Goal of training	Directions	Methods
Self-awareness	Adaptation of children in the developmental environment and to others, the formation of a conscious attitude to sensations within different parts of the body	Forming trusting relationships	Imitation of the child's activities, creating problematic situations, holding therapy
		Formation of feelings of tension and relaxation within parts of the body and motivation for conscious action	Kinesiological exercises with stroking and pulling different parts of the body
Basic communication skills	Formation of individual components of conscious speech	Concentration and recognition of visual and auditory stimuli	Tactile-auditory, tactile-visual, tactile-visual-auditory, auditory-visual stimulation, problematic situations
		Formation of conscious exhalation	Breathing exercises with dynamic accompaniment
		Stimulation of vocal reactions	Problematic situations, vocal exercises with dynamic and musical accompaniment
		Practicing individual movements of the upper torso, head, and arms, which will include the main trajectories required for sign language	Passive-active exercises with dosed care; exercises with the use of stimuli for a specific action
Conscious communication skills	Formation of integral characteristics of situational communication skills, including words and gestures as a symbol of	Formation of sign language	Problematic and game situations
		Forming an idea of the articulation of speech sounds and their sounding	Elements of speech therapy massage, articulation exercises with passive, passive-active, independent, and involuntary levels of performance

	personal need or knowledge	Formation of skill of application of gestures with speech support in a situation	Game and emotionally enriched situations

Source: Author's own conception

We created a multi-sensory environment with simple toys: colored, softballs of different sizes and textures, cubes of different colors and sizes, foam cylinders and soft sticks, small wheels and whirligigs, geometric shapes, and more. The toys were safe in terms of the quality of the selected materials and sizes (the smallest ones were a good fit for the hand but could not be stuffed in the nose or mouth). Some of them could squeak when pressed, some — glow. There was a mat on the ground where we could place a child at any time. The child could come to class with his toy. A mirror hung on one of the walls.

The work *at the first stage* was carried out by the joint efforts of the teacher of physical therapy and speech therapist, who organized the classes. Parents observed the learning process to include the same behavior toward the child at home. At the class, at this stage, they were involved only when necessary for holding therapy.

To form a willingness to interact with an adult, we needed to feel a child's condition to understand what they are going through. The best way to realize this was to imitate their actions and behavior. Our goal was to create a sense of intimacy and go through the training process with a child. Holding therapy was used in extreme cases when it was impossible to focus the child's attention on themselves.

When we noticed that the child's stereotypical movements were reduced, slowed down, and the child focused on the actions of the adult or objects in our hands, we switched to other available actions. We placed other objects in a child's hand until we found the one that worked. The work was carried out until the number of stereotyped movements, hyperreactive and hyporeactive manifestations decreased and the attention focused on the adult.

We gradually adapted the child with ASD to the touch of an adult. We touched various parts of their body (except the head), playing with them. Only after the child reacted to the touch was it possible to introduce exercises to form self-awareness.

In order to form self-awareness, rehabilitation training was carried out in a sequence that corresponds to the dynamics of maturation of motor functions in normative development.

For this purpose, we used a specially formed set of exercises, which included a noticeable smoothing along the body and pulling the limbs with the passive participation of the child. The same exercises prompted them to perform at the passive-active level (when a specialist provided part of the movement, setting the trajectory, and then the child continued the movement). Thus, we optimized the activity of the nerve pathways regulating the processes of tension and muscle relaxation.

The work was carried out in a precise sequence in specific areas:

1. Vertical central – to build a vertical line of the body, which ensured the development of the idea of its integrity, unity, feeling of tension (relaxation) in the back, head, and neck (see Fig. 1. A).
2. Vertical marginal – to form a sense of the boundaries of the right and left in the body, tension (relaxation) in the extremities as the basis for the development of symmetrical movements of the arms and legs (see Fig. 1. B).
3. Vertical middle – to activate the lower nerve nodes, build a horizontal line that divides the body into lower and upperparts, a feeling of tension (relaxation) in the lower part (see Fig. 1. C).
4. Cross external and internal – to intensify interhemispheric interaction and the formation of readiness to perform asymmetric movements (see Fig. 1. D, E).
5. Horizontal external and internal – to activate the nerve nodes in the upper part of the body, which are responsible for the movements of the arms and shoulder girdle (see Fig. 1. F, G).

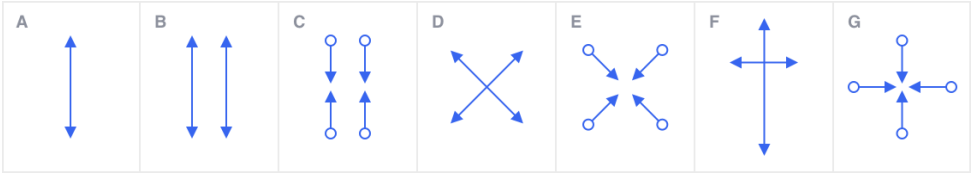

Figure 1. Schemes of development of body movements
Source: Author's own conception

At *the first stage*, the work in the proposed areas was carried out at the passive and passive-active levels. Through experimental learning, we determined that if the child performs exercises at least at the passive-active level, we can move on to the next stage of work.

Any action at higher, involuntary, and independent levels involved the performance of movements with their integrated understanding simultaneously in several projections. Work with such exercises with involuntary and independent performance was carried out in the second and third stages of training.

At *the second stage*, we continued to form the main movements necessary for the intended use of gestures in communication with others. The training was conducted using passive-active exercises and exercises with an insufficient level of performance. To perform them, we used balls of different sizes (those that can be held with one hand and those that need to be held with both hands), elasticity (soft and tight), texture (smooth and rough), with special effects (sounding and glowing by pressure). We performed exercises: "Take the ball with both hands," "Give the ball," "Take the ball with one hand (right-left)," "Transfer the ball from hand to hand," "Watch the ball, reach out to him." In some cases, when the children were not interested in the ball, we replaced it with a cube, stick, or other safe objects. In the process of performing the exercises, we used gestures and speech support "Give," "Take," "Yes," "No." These gestures were reinforced in the process of manipulating other objects and toys.

Ball exercises performed by children with ASD involved tactile-kinesthetic-visual connections and then tactile-kinesthetic-visual-auditory connections, laying a solid foundation for their awareness of auditory and visual stimuli. In the future, these skills were consolidated by using the exercises "Look and listen," "Listen and follow the gaze," "Find," and others. We taught the children to fix their gaze on an object, reach for it, grab it, turn their heads towards the sounding object, and look for it. First, we performed these exercises with specialists in the office and then repeated them with parents as homework.

In parallel, we formed conscious exhalation by using dynamic exercises "Swing," "Pendulum," and others. We laid the child with ASD on the mat, lifted them by the arms in a sitting position, and blew on a particular part of the body — like arm or shoulder — so that the child could feel the breath. Then, we pulled the child's knees to their abdomen, pressed on it, and exhaled, and so on. The work was carried out until the child reacted – breathed purposefully in response.

We stimulated vocal reactions in children with ASD creating problematic situations: "Reach out," "Get out," "Find out." We also used singing to music with the child rocking in different positions. When using the "Hugs" exercise in a sitting position, we hugged the child, rocked, and

sang some of the loud sounds to the music, encouraging them to sing as well.

At the beginning of the second stage of training, classes could be narrowly focused, such as one-skill development. However, according to the child's potential, we gradually included multidirectional work.

At *the third stage,* the speech therapist conducted training with active support and consolidation of the formed skills by parents.

After the formation of basic skills necessary for conscious communication, the system of work included tasks to develop the idea of the phoneme and the word with its primary meaning and teach how to use gestures according to the content of a situation. An essential feature of this stage of training was the integrated nature of the lesson. It included multidirectional tasks that:

1. provided the child with an awareness of the articulation of the sound of speech
2. focused attention on sound
3. contributed to the use of elementary sounds and sound complexes in emotionally enriched subject-practical situations
4. encouraged the situational use of facial expressions and gestures.

It was assumed that touch is not enough for a child to understand sound articulation, but it is essential to feel the place of articulation and the performed movement deeply. For example, lips close when pronouncing -p-; mouth wide open, lips relaxed when pronouncing -a-. For this purpose, we used massage elements (stroking and even rubbing) and articulation exercises with a passive level of performance. Through their use, muscular memory got the idea of the movement required to pronounce a particular speech sound. In parallel with the use of dynamic exercises, we continued to form exhalations, articulating in different ways (mouth wide open, lips extended forward) so that the child could see the articulatory position and feel the airflow on any part of the body: arm, shoulders, neck, and more.

Next, one of the most challenging areas was forming a child's ability to observe and imitate articulatory positions in the mirror. We taught the child to look in the mirror, imitate facial expressions and articulatory positions. During the exercise program implementation at this stage, the speech therapist often uttered a phoneme, which he stimulated in pronunciation so that the child could see his articulatory organs. By applying massage and passive articulation exercises in front of a mirror, we gave the child the opportunity to feel and see the place of formation of articulation of the sound of speech and hear how it sounds. However, we did not require the child to imitate pronunciation. It happened naturally, by imitation.

At *the last stage*, we performed exercises with objects and created play situations in which we provided emotional and semantic content to sounds and words. When using them, we integrated the pronunciation of speech sounds with sign accompaniment.

At the stage of stimulating conscious speech, we conducted training in all the proposed areas in each lesson. At the same time, we assigned a separate lesson for each speech sound. We conducted several classes in a row according to the set scheme until we stimulated the sound and included it in communication. Their number depended on the rate of maturation of the child's holistic idea of the formal image of the phoneme, gesture, and their semantic content, the ability to use verbal, gestural, and facial expressions in the situation to benefit themselves. This format of training was individual for each young patient.

Institutions where we conducted the experimental study, the duration of the experiment, and the total number of participants

The participants of the experiment were selected in 2015 and 2016 based on Kamianets-Podilskyi psychological, medical, and pedagogical consultation and in preschool educational institutions (from now on – PEI) of Kamyanets-Podilsky: in junior, middle and senior groups in PEI №3 (compensating type); in groups of early age and particular purpose in PEI №20; in Kamianets-Podilskyi Training and Rehabilitation Center of Khmelnytsky Regional Council, groups for children of early and preschool age.

To select participants of the formative experiment, we examined 48 Ukrainian children in the nursery (from 21 to 36 months) and 16 children in preschool age (from 3 years 2 months to 6 years) whose communication skill was absent or slightly developed (primary level). Among them, there were 31,25% of girls and 68,75 % of boys (see table 3).

Table 3 Quantitative ratio of the studied children with ASD by gender

Group	Girls		Boys		All	
	n	%	n	%	n	%
Autism spectrum disorder	15	31,25	33	68,75	48	100

The age range of the studied children with ASD ranged from 2 years 5 months to 5 years 11 months at the initial examination (see table 4).

Source: Author's own conception

Table 4 Quantitative ratio of the studied children with ASD by age

2 years old		3 years old		4 years old		5 years old	
n	%	n	%	n	%	n	%
18	37	12	25	10	21	8	17

Source: Author's own conception

According to the results of the diagnosis, 26 children (19 boys and 7 girls) were selected for special training. The other 22 children (14 boys and 8 girls) were assigned to the control group. All subjects confirmed the presence of ASD according to the results of clinical trials and also determined that their communication skills were developed at a primary level.

6. Methods of studying the peculiarities of the development of communication skills in children with ASD

To study the peculiarities of the development of communication skills in children and to select the children for a formative experiment, we used the following methods:

• local (separately within each of the five sensory systems) and polymodal stimulation;

• object manipulation (interaction with toys and objects);

• inclusion in problematic situations ("give", "take", "there is – there isn't", "I can't", "I will not give", "show", "say what is it").

To record the results, we created protocols with predefined observation parameters. To confirm and supplement these results, we developed questionnaires for parents and educators of groups.

In developing observation protocols and questionnaires, we applied an element-by-element approach, taking into account the age parameters of the development of communication skills in a child under two years of age. To implement the element-by-element approach in diagnostics, we identified the following components of communication skills:

• the presence and nature of the emotional arousal manifestation as a reaction to the object of communication or the subject of interaction;

• duration and features of contact with inanimate and animate objects of the environment;

• the presence of imitation of speech and examples of communicative behavior from adults;

• features that accompany the request of the child;

• the presence of the imperative form in communication and its features;

• the formation of the ability to transmit information and the form in which this process occurs.

When analyzing the state of formation of communication skills in children with ASD, we also took into account:

• the presence of proxemic and expressive facial expressions that determine their readiness to establish contact with others;

• understanding and applying the gestures needed to develop self-care skills and satisfy personal needs;

• understanding and using words denoting the names of the environment objects and determining the interests of the child;

• understanding and presence in a speech of words that indicate the actions necessary for situational and business interaction with others.

When analyzing the state of formation of communication skills in children with ASD, the following was taken into account:

1) the presence and total number of proxemic and expressive facial expressions that determine their readiness to establish contact with others (we defined 6 proxemic and 3 expressive facial expressions that reflect the child's willingness to contact others);

2) understanding of gestures necessary for the formation of self-care skills (we defined 8 groups of gestures);

3) use of gestures necessary for the formation of self-care skills in the communication (we defined 8 groups of gestures);

4) understanding the words that denote the names of the objects of the environment and determine the interests of the child (we identified 10 groups of words important at the initial stage for self-awareness, awareness of the environment, and communication with others);

5) situational use of words that denote the name of the objects of the environment and determine the range of interests of the child (we identified 10 groups of words important at the initial stage for self-awareness, awareness of the environment, and communication with others);

6) understanding of words that denote actions necessary for situational and business interaction with others (we defined 8 groups of words important at the initial stage for interaction with others);

7) use in speech of words denoting actions necessary for situational and business interaction with others (we defined 8 groups of words important at the initial stage for interaction with others).

At the final stage of the analysis of research results, we performed a qualitative and quantitative assessment of certain parameters. Due to this, it

was possible to convey the individual characteristics of communication skills in children at the beginning and at the end of the training and determine its effectiveness.

To determine the homogeneity of the control and experimental groups, we performed input diagnostics and statistical processing based on the nonparametric Mann-Whitney U test. After conducting experimental training, we used the same approach to determine the effectiveness of working with children with ASD.

Statistical hypotheses of homogeneity of two independent samples of different numbers were tested. H0: differences in the levels of development of communication skills of children with ASD (control and experimental groups) are not statistically significant, in other words, the groups are homogeneous. H1: differences in the levels of development of communication skills in children with ASD (control and experimental groups) are statistically significant. The obtained data were processed in the SPSS environment. To do this, we entered the results of the diagnosis of communication skills in children with ASD (control and experimental groups) in the table of the environment and performed the analysis.

7. Interpretation of the research results

7.1. Characteristics of the peculiarities of the development of communication skills in the experimental group of children with ASD

As a result, we selected 26 children (19 boys and 7 girls) with initial communication skills were selected for special training according to their diagnosis. All subjects were confirmed to have ASD according to the results of clinical trials.

It was determined that in 11.5% of the studied children, communication skills had not yet begun to develop. In other children with ASD (88.5%), it was at the initial stage of development.

In the majority of the studied children with ASD (88.5%), emotional arousal was manifested in the form of pallidal movements (shaking the body, fingering clothes, waving both hands, nodding the head) and contrasting vocalized reactions: screaming, humming -u-u-u -. In half of the children with ASD, these vocalizations were self-stimulating (50%). Perceived emotional arousal was characteristic of only 11.5% of the subjects. It has been manifested in the form of crying and a conscious smile.

In the vast majority of children with ASD (65.4%), maintaining contact with others was absent, and only 34.6% could maintain some contact with others under the need to ensure ego needs. They already

needed to involve adults in providing personal needs (eating, drinking, using the toilet, giving a toy).

Most subjects (69.2%) were interested in the objects of the surrounding environment, and 34.6% had inherent stuckness when manipulating objects. In the research process, the dependence between subject interest and understanding of gestures was revealed. In all children with a subject interest, an understanding of gestures to satisfy personal needs (eat, drink, go somewhere, use a potty) was observed in parallel, although situational. Individual subjects (34.6%) additionally developed an understanding of the gestures necessary for interaction with adults in everyday life (give/take, yes/no). Some (34.6%) used traditional gestures and individual stereotyped forms of behavior in situations that already signaled a request or an order. For example, they extended their hand with the palm up, which symbolized "give". Alternatively, they approached the item they wanted to get and stepped from foot to foot, swaying with their whole body, symbolizing "give".

Echolalia (repetition of sounds and words) was found in 19.3% of subjects who did not understand gestures.

It was determined that most children with ASD used a request (34.6%) and, to a lesser extent (26.9%), an order in the communication situation. At the same time, these two forms of communication were not manifested in the studied children with ASD. Transfer of information was not formed even at the elementary level among the research subjects.

In addition to the peculiarities of communication skills, the subjects also revealed peculiarities in performing movements and holding positions with different body parts.

All children with ASD were characterized by a delay in the development of the motor sphere, although their manifestations were individual for each child: walking on tiptoes (19.2%), hyposensitivity of the lower part of the body, due to which it was difficult to recognize the need to defecate (15.4%), insufficient coordination of movements (100%), slipping from a chair when sitting for a long time (15.4%).

Manifestations of hyper (hypo) reactivity within the analyzer systems were observed in every child with ASD:

- Increased anxiety as a reaction to sounds (34.6%)
- Lack of response to sounds (7.7%)
- Protest against touching (50%) and the need to undress and walk naked indoors (7.7%)
- Selective tastes in food and the limited amount of products they consume (100%)

Some children with ASD have previously undergone special training to develop communication skills in preschool education and rehabilitation centers (see Table 6).

Table 6 Curricula for which children received special training in a preschool or rehabilitation center

Educational institution	**Number of children (%)**	**Curricula for which the child studied**	**Duration of training**
Training and rehabilitation center	70	A development program for preschool children with intellectual disabilities	1 to 3 years
Inclusive preschool institution	21	A comprehensive program for the development of preschool children with ASD	0 to 1 year
Preschool educational institution	9	A comprehensive program for the development of preschool children	0 to 1 year

Source: Author's own conception

Applying these programs to teach children with ASD was untimely, as it did not have a significant effect. The process of organizing the educational environment did not consider the individual characteristics of the development of these children. Being in a group of peers without proper educational and developmental support also did not contribute to their development and sometimes, on the contrary, deepened the existing violations.

7.2. Place and organizational features of the formative experiment

The special training was conducted based on the training laboratory "Speech Therapy in practice," created at the Department of Speech Therapy and Special Methods of Kamyanets-Podilskyi National Ivan Ohienko University from 2015 to 2020, at the request of parents and with their voluntary participation.

At the first stage of work, classes with the child were conducted by a physical education teacher and a speech therapist. If necessary, parents

joined. In the second and third stages, the speech therapist continued to develop communication skills; the role of other professionals and parents was to consolidate the acquired skill. Classes were held twice a week, assuming some exercises and tasks parents will perform with the child at home. The lessons lasted from 15 minutes in the beginning to 35 or even 45 minutes at the end of the experiment.

The total duration of experimental training was 1 year and 2 months. During this period, 87 to 112 classes were held with each child. In some cases, children missed classes due to good reasons: illness, short trip, etc. In this case, the parents stayed in contact with the teachers who conducted the training, and compensated for the omission by working independently on the advice of experts. In general, the amount of work was significant, so at the stage of experimental training, specialists from the Kamyanets-Podilsky Training and Rehabilitation Center of the Khmelnytsky Regional Council and PEI №3 were additionally involved.

7.3. Characteristics of the process of special training

Analyses of the special education of children with ASD allowed us to highlight what was *familiar* to them all. These symptoms proved the readiness to move on to the next, more difficult stage of work (see Table 7).

Table 7 Characteristics of symptoms that indicate the possibility of moving to the next, more difficult stage of working with a child with ASD

Stages of forming the skill of conscious communication	**Directions for training**	**Symptoms that indicate the possibility of moving to the next direction or stage of work**
Self-awareness	Forming trusting relationships	Acceptance of specialists by the child. Permission of the child to perform joint actions with them.
	Formation of a feeling of tension/ relaxation within parts of the body and motivation for conscious action	The child begins to tense the muscles during the touch and tries to move. The child, leaning on the arms of an adult, sits down from a lying position.
Development of basic communication skills	Focusing and recognizing visual and auditory stimuli	The child fixes his gaze on the object, follows it by turning head, and extends a hand to it. There is a conscious reaction

		(turning the head, torso, fading) to the sound signal.
	Stimulation of vocal reactions	Situationally shows vocal reactions without conscious articulation.
	Formation of conscious exhalation	Purposefully blows through the outstretched lips on light objects, exhales air through a wide-open mouth.
	Practicing individual movements of the upper torso, head, and arms, which will include the main trajectories needed for communication	Freely and purposefully grabs the ball (or another object) when performing different trajectory movements and releases it.
Conscious communication skills	Formation of sign language	Responds correctly to a gesture shown by an adult and indicates his own need through gestures or specific recognizable behavior.
	Formation of the idea of articulation of speech sounds and their sounding	Imitates the articulation of speech sounds during visual observation.
	Forming the skill of using gestures in a situation with speech and facial expressions	Responds to simple instructions according to the content of the situation. Consciously uses sounds, sound complexes, and words that are simple to articulate accompanied by gestures to meet their own needs. Transmits information using simple words and sentences.

Source: Author's own conception

7.4. Effectiveness of the conducted training

As a result of the conducted training, the studied children with ASD managed to form communication skills, which included the vast majority of components:

1. communicative attention, selectively manifested in the form of a glance at the interlocutor

2. manifestations of attention to auditory stimuli in the form of attenuation and listening to them, followed by the rotation of the torso towards the stimulus and brief focusing on it

3. understanding of speech within practical situations, understanding of the meaning of instructions used in everyday life (give, take, show, want to eat, drink, pee, answers yes-no)

4. understanding of words denoting household items and toys, animals that were in the area of observation of children with ASD

5. the ability to imitate sounds; sound complexes and simple words available to pronounce

6. the use of gestures, words, and sometimes even sentences that included a set of amorphous words, roots, babbling, and mismatched words to meet personal needs.

A differentiated feature of the communication skills of the studied children was that some of them (84.6%) developed the ability to express requests, and others (15.4%) - the order, although we did not specifically work on it. Thus, we can conclude that children with ASD do not differentiate these two forms of communication and perceive them as one. They take the expression model from the samples provided by the most authoritative people (mom, dad, grandma, grandpa, brother, sister).

All respondents managed to develop the ability to transmit information, but 61.5% of children with ASD used this form of communication in practical situations directly on the topic of communication, and the rest of the respondents (38.5%) had it postponed. A few days later, the children remembered and talked about the events that caused great emotional arousal in them.

At the end of the study, children with ASD still had difficulties combining the expressive manifestation of the communicative function of facial expressions, gestures, and direct speech into a single form. The most common form used to ensure their communication with others was a gesture (84.6%), supplemented with words and short sentences without facial expressions. Facial and proxemic means, as a rule, acted as something independent and preceded the situation of communication, not accompanied it. 15.4% of respondents mainly used the speech to communicate, ignoring gestures and facial expressions.

In the process of special training, we were able to remove the accompanying negative sensorimotor manifestations:

1. inability to differentiate between inhalation and exhalation, which means that we have formed the conscious speech exhalation

2. perseverance in the process of special training, which has already lasted at least 15 minutes (while at the beginning of the work it lasted from 1 to 5 minutes)

3. the general motility of the whole body was strengthened, which helped to improve the function of walking (removed walking on tiptoe, improved coordination in the process of walking on a straight surface and stairs)

4. hand movements were improved. The ability to take objects with both hands and each hand separately formed, which, in turn, ensured the correct formation of gestures that children demonstrated with one hand. At this stage of development, there is no clear lateralization of functions in children with ASD, and it is unclear what hand is their leading one (right or left). They showed the gesture with one hand or the other.

The statistical analysis based on the non-parametric Mann-Whitney U test before experimental training did not reveal a statistically significant difference between the groups in the state of formation of communication skills before the experiment. This indicates that the groups of children in terms of the formation of communication skills at the beginning of the special training were approximately the same. After the experimental training, a statistically significant difference $p < 0.01$ was found between the results of groups 1 and 2 according to the state of formation of communication skills after the experiment, which confirmed the effectiveness of the developed methodology (see Table 8).

Table 8 Data received based on using non-parameter Mann-Whitney U test before experimental training and after it

Research parameters	**Parametric data obtained in the comparative analysis of the state of formation of communication skills in the experimental and control groups at the** critical value U 0,01 = 173.0, U 0,05 = 205.0	
	before the experiment	**after the experiment**
Use of proxemic and facial means in the situation of communication	U emp. = 273.5	U emp. = 29.0
Understanding the gestures used by others in a communication situation	U emp. = 217.0	U emp. = 51.5
Use of the gestures used by others in a communication situation	U emp. = 223.0	U emp. = 38.0
Situational understanding of words denoting the names of the subjects	U emp. = 334.5	U emp. = 111.0
Situational use of words denoting the names of the subjects	U emp. = 230.5	U emp. = 73.5
Situational understanding of words denoting the actions of the subjects	U emp. = 289.5	U emp. = 139.0
Situational use of words denoting the actions of the subjects	U емп. = 320.5	U емп. = 31.0
The state of formation of communication skills in general	U emp. = 259.0	U emp. = 0.0
	The hypothesis H0 is accepted: There was no statistically significant difference between the groups in the state of formation of communication skills before the experiment.	The difference between the results of groups 1 and 2 on the state of formation of communication skills after the experiment is statistically significant $p \geq 0,01$

Source: Author's own conception

8. Conclusions and prospects for further research

Thus, the experiment revealed the effectiveness of the described technique for forming primary communication skills in children with ASD, both with preserved intelligence and with intelligence disorders.

We determined that the stage of development of the children's basic skills and self-awareness (which allows them to adapt to the new environment and minimize negative behavioral manifestations) should go before forming their communication skills. In the future, these skills can be integrated into one complex communication skill, including facial expressions, gestures, and verbal components.

The system of exercises and tasks focused on touching and activating kinesthesias within all parts of the body turned out to be the essential means of intensifying the development of children with ASD. At the beginning of the exercise, with stroking and pulling certain parts of the body, we focused the child's attention on themselves and awakened their consciousness to form a conscious gesture and the most specific articulatory positions, essential for the pronunciation of speech sounds. We also used other sensory systems (auditory, visual), forming the essential skills for conscious communication: focusing on the interlocutor, gestures, purposeful exhalation and voice formation, pronunciation of simple words, and more. At the same time, the tactile system remained central, thanks to which the signals combined into a holistic, conscious form of communication.

In the course of the research, several issues arose that will require further study. In particular, when talking about the best period to start working with children with ASD, experts indicate the early age (the earlier, the better). However, in our work, the most promising factor for the beginning of learning with a child was the factor of timeliness, which requires further, deeper study. Effectively selected time to start working with a child with ASD depended, on the one hand, on the child's maturity, and the other – on the willingness of parents to understand the content of the problem and take an active part in the learning process.

The stability of their communication skills remains a problem in teaching children with ASD. Under what conditions does it disintegrate, and in which cases does it persist? These and other issues will be the subject of our future research.

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