



TECHNOLOGIES FOR DEVELOPING SPEECH MOTOR SKILLS IN CHILDREN WITH MUSCULOSKELETAL DISORDERS

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Article history:	Abstract:
Received: 26 th March 2026 Accepted: 24 th April, 2026	This article analyzes the scientific and theoretical foundations of technologies for developing speech motor skills in children with musculoskeletal disorders. The impact of musculoskeletal impairments on the functioning of the articulatory apparatus, speech breathing, phonation, and communicative development is highlighted. The article substantiates the effectiveness of articulation gymnastics, speech therapy rhythmic, sensory integration technologies, multimodal approaches, and information and communication tools in the development of speech motor skills. In addition, the importance of comprehensive corrective-developmental activities, cooperation among specialists, and parental involvement is revealed. According to the research findings, a comprehensive approach organized on the basis of modern speech therapy technologies effectively contributes to the development of speech motor skills and communicative activity in children with musculoskeletal disorders.
Keywords: musculoskeletal system, speech motor skills, articulatory motor skills, speech therapy, corrective-pedagogical activity, sensory integration, speech therapy rhythmic, multimodal technologies, communicative activity, cerebral palsy, speech breathing, articulation gymnastics, special pedagogy, innovative technologies, psychomotor development.	

At the global level, supporting children with special educational needs, ensuring their social adaptation, and providing access to quality education are recognized as priority directions of modern pedagogy. In particular, the rehabilitation of children with musculoskeletal disorders, the development of their communicative activity, and ensuring their successful integration into society are considered among the urgent problems of special pedagogy and speech therapy. In recent years, special attention has been paid to the development of comprehensive corrective technologies aimed at supporting not only the physical but also the speech and psychological development of this category of children. Musculoskeletal disorders negatively affect not only the child's general motor development but also speech motor skills. Organic damage to the central nervous system, impaired muscle tone, limited mobility of the articulatory apparatus, and difficulties in general motor coordination result in various impairments in the phonetic-phonemic, lexical-grammatical, and communicative aspects of speech in such children. In particular, children with cerebral palsy commonly experience impairments in articulatory motor skills, speech breathing, voice production, and speech tempo, which significantly limit their speech communication activity.

Speech motor skills constitute the physiological and functional basis of human speech activity. Precise, coordinated, and rhythmic movements of the articulatory apparatus are essential for correct sound pronunciation, fluent speech formation, and the development of communicative activity. However, in children with musculoskeletal disorders, disturbances in the functional relationship between general motor skills and speech motor skills lead to weakness of articulatory movements, lack of coordination, and limited mobility of speech organs. Therefore, organizing corrective-pedagogical activities aimed at developing speech motor skills in these children on the basis of modern technologies is of important scientific and practical significance. Today, large-scale reforms are being implemented in the Republic of Uzbekistan to support children with disabilities, ensure their right to education, and develop the inclusive education system. In particular, the Law of the Republic of Uzbekistan "On Education," the Law "On the Rights of Persons with Disabilities," as well as decrees and resolutions of the President of the Republic of Uzbekistan related to the development of inclusive education, have strengthened the legal foundations for the corrective-pedagogical support of children with special educational needs.

In particular, the Resolution of the President of the Republic of Uzbekistan No. PQ-4860 dated October 13, 2020, "On Measures to Further Improve the System of Education and Upbringing for Children with Special Educational Needs," identified the expansion of the inclusive education system, improvement of the quality of special pedagogical support, and implementation of corrective-developmental technologies into practice as priority tasks. Furthermore, by the Resolution of the Cabinet of Ministers No. 638 dated October 12, 2021, the mechanisms for organizing inclusive education were improved, and the system of pedagogical and psychological support for children with special needs was

further developed. These regulatory and legal documents serve as an important methodological foundation for increasing the effectiveness of speech therapy and corrective activities carried out with children who have musculoskeletal disorders.

In the studies of Nikolai Bernstein, Jean Piaget, Karel Bobath, Berta Bobath, A. Jean Ayres, and Elena Mastjukova, the interrelationship between motor and speech activity, sensorimotor development, and the correction of speech motor skills in children with cerebral palsy were scientifically substantiated. According to these scholars, disorders of the musculoskeletal system directly affect the functioning of the articulatory apparatus, speech breathing, phonation, and overall communicative development of the child. Therefore, the use of a comprehensive approach based on neuropsychological, sensory integration, speech therapy rhythmic, and multimodal technologies in the process of developing speech motor skills yields high effectiveness.

This article analyzes the scientific and theoretical foundations of technologies for developing speech motor skills in children with musculoskeletal disorders, the psychological and pedagogical characteristics of speech motor development, and the effectiveness of modern speech therapy technologies. In addition, the practical significance of using innovative pedagogical approaches in corrective-developmental activities is highlighted.

Impairments in motor activity occupy a central place in the development of children with musculoskeletal disorders. These impairments negatively affect not only the general motor system but also the functioning of the articulatory apparatus and speech motor skills. In particular, in cases of cerebral palsy, paresis, and paralysis, disturbances in muscle tone, insufficient motor coordination, and limitations of voluntary movements lead to various difficulties in the functioning of speech organs as well. Speech motor skills are considered a complex physiological process formed on the basis of the coordinated motor activity of the organs of the speech apparatus. The harmonious movements of the tongue, lips, soft palate, lower jaw, and respiratory apparatus ensure correct pronunciation, fluent speech, and accurate articulation. However, as a result of disorders in the musculoskeletal system, these movements become weakened, uncoordinated, or limited. Consequently, children exhibit dysarthric disorders, phonetic impairments, and deficiencies in speech tempo and rhythm.

In his theory of motor control, Nikolai Bernstein substantiated the complex neurophysiological mechanisms of motor development. According to the scholar, any motor activity is carried out through the coordinated functioning of the central nervous system and peripheral analyzers. Therefore, impairments in the motor system directly affect speech activity as well.

In the theory of sensorimotor development, Jean Piaget emphasized that a child's cognitive activity is formed on the basis of movement and sensory experience. According to the scholar, limitations in motor activity negatively affect the child's communicative and speech development. This necessitates a comprehensive corrective approach for children with musculoskeletal disorders.

One of the distinctive features of speech motor development in children with musculoskeletal disorders is the impairment of articulatory muscle tone. As a result of hypertonicity or hypotonicity of the muscles, tongue and lip movements become inaccurate, slow, and weak. In some cases, maintaining articulatory positions becomes difficult, leading to impaired sound pronunciation. Difficulties are especially observed in the pronunciation of affricate, fricative, and sonorant sounds.

Speech breathing disorders are also common in such children. Due to shallow and irregular speech breathing, sufficient air supply is not maintained until the end of a sentence. This leads to reduced speech fluency and intonational expressiveness. Therefore, along with articulatory motor skills, the development of speech breathing is considered one of the important directions in the process of developing speech motor skills.

Modern Speech Therapy Technologies for the Development of Speech Motor Skills

Today, innovative speech therapy technologies are widely used in the development of speech motor skills in children with musculoskeletal disorders. Modern corrective technologies are organized on the basis of a comprehensive pedagogical, psychological, and rehabilitative approach while taking into account the child's individual abilities.

Articulation Gymnastics Technologies

Articulation gymnastics is a system of special exercises aimed at developing the mobility of speech organs. These exercises improve the functioning of the articulatory apparatus by activating the muscles of the tongue, lips, soft palate, and lower jaw.

In children with musculoskeletal disorders, articulation exercises are conducted gradually and on the basis of an individual approach. In particular, the combined use of static and dynamic exercises helps normalize muscle tone and develop articulatory coordination.

Speech Therapy Rhythmics

Speech therapy rhythmics is a corrective technology based on the integration of musical rhythm, movement, and speech elements. This method contributes to the development of motor coordination, normalization of speech tempo and rhythm, and activation of general psychomotor activity.

In the neurorehabilitation approaches developed by Karel Bobath and Berta Bobath, the harmonious development of motor and sensory activity occupies an important place. These technologies are currently applied effectively in speech therapy rhythmics sessions as well.

Sensory Integration Technologies

Sensory integration technology is considered a modern corrective method aimed at the harmonious development of the child's sensory systems. Through this technology, the activation of vestibular, proprioceptive, and tactile sensations positively influences the development of speech motor skills.

According to the sensory integration theory developed by A. Jean Ayres, impairments in processing sensory information negatively affect the development of motor and speech activity. Therefore, sensory integration exercises are used as an effective means of developing articulatory and general motor skills in children with musculoskeletal disorders.

Multimodal Technologies

Multimodal technologies are based on the simultaneous use of several analyzers in the development of speech motor skills. The integration of visual, auditory, and kinesthetic tools helps activate the child's speech activity.

Interactive presentations, video exercises, touchscreen programs, and animated speech therapy games increase children's motivation toward learning activities. In particular, sessions organized through digital technologies make it possible to visually demonstrate articulatory movements.

The Importance of Comprehensive Corrective-Developmental Activities

The development of speech motor skills in children with musculoskeletal disorders should not be limited only to speech therapy sessions. High effectiveness can be achieved only when this process is organized comprehensively through the cooperation of teachers, speech therapists, psychologists, physiotherapists, rehabilitation specialists, and parents.

Comprehensive corrective activities include the following directions:

- development of general motor skills;
- fine motor exercises;
- activation of articulatory motor skills;
- development of speech breathing;
- formation of communicative activity;
- psychological support;
- development of social adaptation.

Scientific studies particularly emphasize the close relationship between fine motor skills and speech development. Exercises aimed at developing finger movements help activate the speech centers of the central nervous system. Therefore, activities such as working with mosaics, construction sets, plasticine, and finger games are considered important tools for the development of speech motor skills.

In addition, the family environment and parental involvement are regarded as important factors that increase the effectiveness of the corrective process. Continuing regular exercises at home, stimulating the child's speech activity, and providing emotional support ensure the stability of speech motor development.

The development of speech motor skills in children with musculoskeletal disorders is considered one of the important and relevant areas of modern special pedagogy and speech therapy. Analysis of research shows that disorders of the musculoskeletal system negatively affect not only the child's general motor development but also the functioning of the articulatory apparatus, speech breathing, phonation, and communicative activity. As a result, such children develop various impairments in the phonetic-phonemic, lexical-grammatical, and prosodic aspects of speech.

Speech motor skills constitute the physiological basis for the formation of полноценной speech activity in children. The coordination of articulatory movements, the normal state of muscle tone, and the proper formation of speech breathing serve as important factors in the development of fluent and accurate speech. Therefore, it is necessary to organize corrective-pedagogical activities aimed at developing speech motor skills in children with musculoskeletal disorders on the basis of scientifically grounded and comprehensive approaches.

The article scientifically substantiated the effectiveness of articulation gymnastics, speech therapy rhythmic, sensory integration technologies, multimodal approaches, and innovative information and communication tools in the development of speech motor skills. In particular, it was determined that activities organized on the basis of multimodal technologies are highly effective in activating children's articulatory movements and increasing communicative activity through the integration of visual, auditory, and kinesthetic analyzers.

Furthermore, the importance of comprehensive corrective-developmental activities was highlighted separately. A systematic approach based on the cooperation of speech therapists, teachers, psychologists, rehabilitation specialists, physiotherapists, and parents makes it possible to effectively support the child's speech development. In particular, methods aimed at developing fine motor skills, sensorimotor exercises, speech breathing exercises, and stimulating communicative activity were identified as important components of speech motor development.

It was also substantiated that the family environment and the active participation of parents are important pedagogical factors that increase the effectiveness of corrective activities. Continuing regular exercises at home, stimulating the child's speech activity, and providing emotional support ensure the stability of speech motor development.

In conclusion, the use of modern speech therapy technologies, innovative pedagogical approaches, and a comprehensive corrective system in developing speech motor skills in children with musculoskeletal disorders demonstrates high effectiveness. These approaches play an important pedagogical role in activating children's speech activity, developing communicative competence, improving social adaptation, and ensuring successful integration into society.

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