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Stimulation of Auditory Perception in Children Using Maria Montessori's Developmental Materials

Stymulowanie rozwoju percepcji słuchowej u dzieci z wykorzystaniem materiałów rozwojowych Marii Montessori

KEYWORDS

auditory perception, stimulating auditory perception, Montessori method, sensory material, prepared environment, child development, sensory development

ABSTRACT

Auditory perception is an important area of a child's cognitive development because it determines the development of speech and influences writing and reading skills. Irena Polewczyk defines it as "active reception of auditory stimuli scattered around a person, based on the ability to differentiate speech sounds and their analysis, synthesis and interpretation in accordance with the knowledge, memory and experience that a person has" (Polewczyk, 2017, p. 149). The human body is adapted to receive impressions from the outside world; it segregates, processes and interprets them in the mind. In this way, a person acquires experiences that determine the development of subsequent, more and more precise skills. In the process of developing auditory perception, an important role is played by the child's immediate environment, which, through appropriate interactions, influences the process of shaping auditory functions. The aim of this article is to present theoretical assumptions regarding the development of auditory perception and the possibilities of stimulating auditory development through the use of Maria Montessori's teaching aids. The first part of the article describes the development of auditory perception in children. Then, theoretical assumptions regarding Montessori development aids and the possibility of using them in developing auditory skills are presented.

SŁOWA KLUCZE

percepcja słuchowa, stymulowanie percepcji słuchowej, metoda Montessori, materiał zmysłowy, przygotowane otoczenie, rozwój dziecka, rozwój sensoryczny

ABSTRAKT

Percepcja słuchowa jest istotnym obszarem z punktu widzenia rozwoju poznawczego dziecka, ponieważ warunkuje rozwój mowy oraz wpływa na kształtowanie umiejętności pisania i czytania. Irena Polewczyk definiuje ją jako: „aktywny odbiór bodźców słuchowych rozporoszonych wokół człowieka, oparty o umiejętność różnicowania dźwięków mowy oraz ich analizy, syntezy i interpretacji zgodnej z wiedzą, pamięcią i doświadczeniem, które posiada człowiek" (Polewczyk, 2017, s. 149). Organizm ludzki jest przystosowany do odbioru wrażeń ze świata zewnętrznego, segreguje je, przetwarza oraz interpretuje w umyśle. W ten sposób nabywa doświadczeń, które determinują kształtowanie kolejnych, coraz bardziej precyzyjnych umiejętności. W procesie rozwoju spostrzegania słuchowego ważną rolę odgrywa najbliższe otoczenie dziecka, które poprzez odpowiednie oddziaływania ma wpływ na przebieg procesu kształtowania funkcji słuchowych. Celem niniejszego artykułu jest przedstawienie założeń teoretycznych dotyczących rozwoju postrzegania słuchowego oraz możliwości stymulowania rozwoju słuchowego poprzez wykorzystanie pomocy dydaktycznych Marii Montessori. W pierwszej części artykułu opisano rozwój percepcji słuchowej u dzieci. Następnie przedstawiono założenia teoretyczne dotyczące pomocy rozwojowych Montessori oraz możliwości ich wykorzystania w rozwijaniu sprawności słuchowej.

Introduction

The ear is a sense organ that receives sound stimuli from the environment. This information is processed and integrated in the brain structures and, together with impressions from the other senses, build mental representations of the external world. Properly functioning hearing makes it possible to register acoustic stimuli and thus obtain information about the surrounding reality (Kurkowski, 1998, p. 289). Auditory perception is developed in children already in prenatal life and it is one of the first sensory systems that determine proper development due to the wide range of functions it performs. Hearing is responsible for receiving, identifying and discerning sound stimuli, locating them in space, and remembering them. Thanks to these tasks, a person learns to function in the surrounding world by shaping adaptive reactions to the stimuli he/she receives.

> The role of perception is to give meaning to impressions. Making sense means going beyond purely sensory processing to create our own understanding of the physical reality we experience. This involves many different mental processes, such as synthesising parts into a whole, assessing sizes, shapes, distances, intensity and pitch of sound;

> estimating what is unknown and uncertain based on known features; recalling past experiences with a currently operating stimulus, comparing various currently operating stimuli, associating the perceived features of stimuli with appropriate ways of reacting (Zimbardo, 1999, p. 266–267).

Hearing enables the reception of various acoustic stimuli and registers even subtle stimuli, which often constitute warning signals and ensure safety against threats. In turn, listening to the sounds of nature or pleasant music leads to calmness, achieving a state of internal balance, and builds concentration of attention. Moreover, hearing plays a socialising role because it is a communication tool that allows one to function freely in social life. Through well-developed auditory perception, a person learns to identify and understand emotions.

The development of perception in children is continuous and is related to improving the interpretation of processed information. As you grow up, the so-called sensory sensitivity, which manifests itself in increasing precision in perceiving stimuli, and sensory sensitivity, i.e. the ability to distinguish information, improves. Moreover, due to high activity, the child acquires the ability to intentionally receive stimuli, which is manifested by increasing concentration of attention and conscious search for specific sensations. The last and most important stage is the period when the recorded stimuli become the subject of cognition and serve to improve one's own sensitivity and sensory sensitivity (Matczak, 2003, pp. 51–53).

During development, the sense organs undergo a process of improvement and specialisation. In early childhood, it occurs automatically due to the multitude of incoming information from the environment and the need to analyse and segregate it by the central nervous system. However, already in the first year of life, the essence of the child's own activity is noticed, which exercises the sensory apparatus through individual actions.

> Numerous observations and studies show that sensitivity increases when the received impressions have a specific function in action, especially when they are important for the performance of tasks. Sensations are then a source of important information, which causes active focus on the content of sensory experiences and their reception (Matczak, 2003, p. 54).

Development of Auditory Perception

Hearing develops already in the fetal period, and in the first trimester of prenatal development it is the most developed sensory organ. Around the 4th and 5th month of fetal life, the baby's response to sound sensations is noticed, which means that

these stimuli are received and processed by the nervous system. Auditory memory and sound differentiation are also developed in the prenatal period. Research shows that the child is more sensitive to high-frequency sounds (Kurkowski, 1998, p. 291).

Even though its hearing was developed in utero, the newborn shows primarily reflex reactions to acoustic stimuli, which proves the immaturity of the nervous system. Hearing functions are improved by the child's increased activity and sound stimulation. Thanks to intensive psychomotor development, around 2–3 months of age the so-called cooing occurs, i.e., sounds articulated in a posterior manner. During this period, the efficiency of head movements increases, thanks to which the child can follow and locate sound stimuli. Around 4 months of age, you may notice a reaction to the tone of speech. The child develops the ability to differentiate intonation and sound intensity. In the 6th month of life, babbling is observed, i.e., frequent reproduction of sounds produced by the baby and the environment. This phenomenon is the result of the maturation of the brain's association fields in the area of auditory-motor coupling. The later months of the child's life bring the development of locomotion and manipulation skills. The infant learns the acoustic features of the surrounding world and gains the ability to differentiate auditory stimuli. At this stage, the child also develops the ability to vocalise in order to communicate his/her own emotions and needs. Around the first year of life, a child pronounces syllables and sequences of syllables and tries to imitate words spoken by people around him. During this time, the child also masters the basics leading to the development of phoneme hearing. The second year of life is the time when there is a strong need for communication, which is why hearing functions develop, especially in the area of speech sound perception. The child creates auditory patterns of words and stores them in his or her mind. The need to remember and distinguish them contributes to improving auditory memory, phonemic hearing and discovering the phonological and phonetic structure of utterances (Kurkowski, 1998, p. 292–293). In the third year of life, the child expands vocabulary and improves grammatical correctness. The next stage is the ability to analyse sounds, i.e., the deliberate, sequential identification of sounds, and sound synthesis, i.e., combining sounds into a whole. The ability to analyse and synthesise voice determines the process of acquiring writing and reading skills. Phonemic hearing disorders negatively affect speech reception and its development. Moreover, they make it difficult to acquire reading and writing skills (Kruczyńska & Kurkowski, 2015, p. 63). In turn, difficulties with accurate and/or fluent word reading and low spelling skills are characteristic of dyslexic disorders which have a neurobiological basis and result from a phonological processing deficit (Erbeli et al., 2021, p. 1).

Auditory perception is shaped by one's own activity and experiences. The environment, parents and teachers also play an important role, as they are responsible for creating a stimulating environment in a conscious and planned way. One of the most

important educational and didactic tasks is to prepare children to master reading and writing skills, based on phonological competence, i.e., awareness of the sound structure of language and the ability to reflect and manipulate speech sounds. M. Lipowska considers the ability to auditorily differentiate phonemes, perform operations on syllables, phonemes and intra-syllable elements as the components of phonological competence (Lipowska, 2001, pp. 24–44). Writing and reading are complex processes based on the ability to isolate phonemes. The child learns the correlation between sounds and letters, which enables letter encoding of words (in writing) and their decoding (reading) and gaining access to the semantic layer (Snowling et al., 2020, p. 503).

Each oral statement consists of a number of acoustic elements. A very important component is the prosodic system, which consists of intonation, stress, rhythm, quantity, pause and tempo, and facilitates the transmission of meanings, intentions and emotions of the interlocutor. A child participating in linguistic interactions develops prosodic competences by experiencing the expressive melody of the messages addressed to him. He learns to notice suprasegmental phenomena and features and their meaning, which later influences the development of fluent reading comprehension skills (Wysocka & Kwaterewicz, 2018, p. 330). Prosodic competence is biologically determined due to the efficiency of physiological hearing and the ability to differentiate sound intensity, duration and timbre. Auditory memorisation of specific structures, sound association of speech and auditory self-control are also important. The efficiency of cognitive functions enables the adequate interpretation of suprasegmental phenomena and the adaptation of one's own prosodic behaviour to the communication situation (Wysocka, 2014/2015, p. 122).

The ability to analyse prosodic features develops already in early childhood. Prosodic structures noticed in the child's environment allow for distinguishing individual linguistic elements from the sequence of speech, such as phrases and words. The child learns their structure and meaning and notices the functions of prosodic phenomena in communication (Wysocka, 2014/2015, p. 124).

Physical, phonemic and prosodic hearing are part of the perceptual biological abilities which, despite their mental foundation, are fulfilled in the social sphere of man, because they directly influence his communication skills, and, as Grabias states, "language and linguistic behaviour organise social life, and their deficiencies place an individual on the margin of this life" (Grabias, 2012, p. 38). Each linguistic interaction requires knowledge related to the communication situation and the rules that govern it. In the socialisation process, a person develops communication competence regarding patterns of interactive behaviour and rules for constructing statements. Moreover, members of social groups are equipped with mental mechanisms for generating grammatically correct sentences of a given language, i.e., linguistic competence (Grabias, 2012, p. 21). Acquiring language and communication competence at an appropriate

level enables the development of cultural competence, i.e., the ability to participate in culture through the interpretation of symbolic behaviour (Michalik, 2016, p. 20).

Stimulating auditory functions which constitute the biological basis for the development of language and communication skills, will have a positive impact on the development of linguistic, communicative and cultural competences. "Both competence and implementation are built primarily on the biological capabilities of the individual and are an expression of the mobility of his brain and the state of peripheral processes involved in the implementation of statements" (Grabias, 2012, p. 39).

Maria Montessori's Teaching Aids

Montessori's development material was created on the basis of the researcher's and her colleagues' long experience in working with children and experimental psychology research, as well as aids created by French doctors Itard and Seguin, used in working with children with intellectual disabilities (Montessori, 2014, p. 91). The teaching materials constitute a specific system of subjects enabling the improvement of a specific skill. "Each group exhibits one constant characteristic, but to varying degrees. We are, therefore, dealing with gradation in which the change occurs evenly from one subject to another, and the difference is constant and, if possible, determined mathematically" (Montessori, 2014, p. 92). Montessori developmental aids implement the principle of grading and isolating difficulties, which means that, in the course of work, individual exercises increase the level of difficulty and always refer to one selected skill that is improved. Montessori, through many years of experience in working with children of different ages, noticed that a child's attention is labile and easily distracted. Therefore, the elements of the sets have the same form, color, shape and size, differing only in one specific feature. Such organisation of assistance helps focus the child's attention on improving a specific skill and develop sensory sensitivity (Guz, 2006, p. 40). Moreover, aids designed to develop the senses have features that can be graded, and putting the extreme elements of the set together creates the most striking contrast and allows you to highlight differences that are easy for a child to notice. Montessori development materials assume the child's own, spontaneous activity due to the included error control. Thanks to the possibility of self-control, the child becomes more aware, careful, accurate, and develops concentration of attention. "Self-control guides the child's activities, outlines the goals of action, and is a means to achieve perfection" (Guz, 2006, p. 43). In addition, it shapes critical thinking, develops the ability to analyse actions taken and their effects, improves senses and mental activities, enriches knowledge, and strengthens self-esteem. Through sensory material, children learn through experience and build representations in their minds of specific sensory

phenomena that are difficult to explain in words. "We give them some abstraction and they learn to understand it thanks to our teaching materials. We call this mechanism "materialised abstraction" (Montessori, 2019, p. 112).

Maria Montessori emphasized the aesthetic aspect of the prepared aids, which serves a motivating function. "Color, shine, harmony of forms, make objects attractive to children, attract their attention, encourage them to use them in activities" (Guz, 2006, p. 44). The child's prepared environment in the kindergarten and Montessori school attracts attention and encourages the child to be active, explore and repeat exercises. Montessori material is always available in limited quantities and serves a specific purpose, which introduces harmony and order into the course of action and builds structure in the child's mind. Moreover, each aid is available in one copy, thanks to which the child learns to make decisions, be patient and plan their own work. Teaching materials are presented during individual, short lessons, the so-called presentations, during which the teacher presents the purpose of a given aid by performing a model demonstration. Then the child has the opportunity to act independently and freely, explore the exercise and decide how long he or she will engage in a given activity. The great variety and orderliness of help in the child's environment result in the development of independence and decision-making, in accordance with the child's developmental possibilities and interests (Guz, 2006, p. 45–46).

Stimulating Auditory Perception in Maria Montessori's Method

Maria Montessori's auditory perception improvement program begins perversely by drawing attention to silence, which is the reference point for all sounds registered by the hearing organ. Montessori developed the so-called silence lessons, which not only shape children's sense of silence in the educational process, but also allow them to turn inward and discover their own feelings and thoughts. Silence exercises require effort, inhibition and self-discipline, but observations show that children willingly participate in them (Guz, 2006, p. 34). Experiencing silence gives you the opportunity to concentrate on sounds from the environment, consciously direct your attention to individual sounds, and develop the ability to identify and differentiate them.

Montessori drew attention to children's increasing ability to hear auditory perception and notice stimuli with minimal differences. She distinguished four classes of auditory sensations that come from silence, the human voice, sounds (murmurs) and music (Montessori, 2014, p. 121). The differentiation of sounds is created using six wooden boxes, available in two sets. Each can produce a slightly different sound. As the child learns the sounds, he or she can grade their intensity and arrange the cans

in order from the loudest to the quietest. The presence of two sets also makes it possible to find pairs of the same sounds (Montessori, 2014, p. 121). Exercises with noise cans sensitise the child to subtle differences in sounds, which later translates into the differentiation of phonemes that are similar to each other, but stand out due to one distinctive feature, e.g., the degree of proximity of the speech organs.

Another material, important from the point of view of the development of auditory perception, is a set of eight bells producing different tones corresponding to the C major scale in two sets, and a set of bells presenting semitones. Children learn to differentiate tones, find pairs and arrange them in the right order (Montessori, 2014, p. 122). Numerous scientific studies prove that musical structures are similar to prosodic structures, therefore stimulation of musical hearing translates into greater sensitivity of prosodic hearing. "Exercises using music teach the child to differentiate sound features and develop the perception of melody (intonation), accent, tempo and rhythm in both music and speech" (Wysocka, 2014/2015, p. 130). Moreover, there is a relationship between the perception of rhythm and phonological awareness and the development of language skills. Children who scored better in the area of phonological awareness had higher abilities to distinguish complex rhythms (Gordon et al., 2015).

In her language development program, Montessori included a number of materials to improve phoneme perception. Phonemic hearing is a basic skill that enables the identification and discrimination of basic linguistic units, i.e., phonemes, and more complex structures, i.e. words and utterances. Moreover, it shapes the phonological system in the mind. Properly functioning phoneme hearing is an obligatory condition for developing the ability to analyse and synthesise syllables and sounds. It is one of the basic processes determining the development of writing and reading skills (Gruba, 2012, p. 7).

Phonological sensitivity develops gradually. Stanovish (Maurer, 2003) used the concept of a continuum of phonological sensitivity, taking into account its various levels. The ability to focus on phonemes and manipulate them indicates the deepest level of development of phonological sensitivity in a child, but distinguishing only larger parts of spoken language, i.e. a syllable or intra-syllable elements, indicates its low level (Maurer, 2003, p. 14). Phonemic hearing exercises should be adapted to the possibilities and skills of children, starting from shaping the perception of units that are easier for the child to hear, ending with distinguishing the smallest elements, phonemes, slightly different from each other.

> The state of phonemic hearing depends largely on training and on exercises in recognising one's own sounds and those of other people. Its condition is influenced by orthophonic and musical exercises. The state of phoneme hearing determines the expressive and impressionistic form of texts (Rocławski, 1991, p. 27)

Through exercises with small objects called "sound games", the child learns in three stages to distinguish the onset, pairs of phonemes and the position of the phoneme in a word. Sound games are an extremely important stage in improving phonemic hearing and constitute a basis for learning letters and writing. The teacher decides on the selection of material taking into account the principle of grading difficulty. The easiest sounds for children to recognise are sounds pronounced with prolongation, i.e., vowels, sonorous consonants, and fricatives. It is more difficult to distinguish the so-called momentary consonants, i.e., plosives, and differentiate *i* and *j*. In shaping phoneme perception, it is also important to pay attention to the position of the sound in the word. It is easier for a child to hear the first vowel that forms an independent syllable, the last consonant of a word and the first consonant in the initial syllable than to identify the missing sound in a word or to identify the last vowel in a word, the vowel in the mid-voice and the sound in the consonant group (Styczek, 1982, p. 18).

It is worth preceding the exercises in distinguishing sounds with various games that will make children aware of specific segments occurring in the language, i.e., sentences, words, syllables, which is why it is important to read stories to children and comment on the text they hear, teach rhymes, lists, rhythmic and musical-verbal games (Guz, 2006, p. 53). Developing phonetic hearing and the perception of individual sounds is important for developing the skill of phoneme analysis, i.e., consciously distinguishing the sounds that appear in a word.

A child with appropriate auditory sensitivity is ready to learn letters. In the Montessori method, this is achieved by a sandpaper alphabet, i.e., blue and red tablets with letters cut from sandpaper glued to them. The entered letters are associated with the corresponding sounds, thanks to which the child can identify, distinguish and remember them. An additional aspect supporting the perception of letters is tracing rough shapes with your fingers, which triggers muscle memory. After acquiring most of the letters, the child starts working with the so-called movable alphabet that allows you to compose words and sentences using letters cut out of plastic. The movable alphabet gives you the opportunity to improve phoneme analysis by precisely selecting letters that appear in sequence. "The word is arranged letter by letter, according to the sounds that make it up […]. It is both a word analysis and a great means of improving spelling" (Montessori, 2014, p. 187).

Summary

Montessori developmental material provides many opportunities to develop auditory perception in younger and older children. Aids in the field of sensory and linguistic exercises improve hearing at various levels and thus influence the process

of developing reading and writing skills. These processes depend on the processing of information, i.e., sounds in a word, words in a sentence, and sentences in a longer utterance, and children who are preparing to start learning to write and read must, first of all, become aware of what elements spoken and written language are made of (Maurer, 2003, p. 7). Auditory perception develops gradually, therefore Montessori development aids based on recognising and distinguishing sounds and tones build primary skills and constitute the basis for developing skills requiring greater precision in registering stimuli, e.g., speech sounds. In turn, exercises to improve phoneme hearing, introduced in stages, taking into account the principle of grading difficulty, enable successive achievement of the ability to identify and differentiate sounds and lead to the development of sound analysis skills, which determine the correct writing of words. The mental operations that participate in the process of phoneme analysis are complex and may not appear at all without conscious teaching activities (Tijms, 2004, pp. 300–308). Sabina Guz, in her book entitled *The Montessori Method in Kindergarten and School*, describes research on the developmental achievements of children in preschool and school. The researcher's aim was to compare the results achieved by children educated according to a commonly used model in Polish educational institutions and in the Montessori system. The analysis of material regarding auditory perception and the development of language skills showed better results obtained by children from Montessori classes (Guz, 2006, pp. 95–162). It can, therefore, be concluded that Montessori pedagogy significantly supports the development of auditory perception through its fundamental assumptions, i.e., a prepared environment, which is a rich offer of teaching materials and tasks, and an individualised organisation of the educational process, taking into account the needs and capabilities of each child.

Stimulating auditory perception according to Maria Montessori's principles is also possible in kindergartens and traditional schools. Montessori developmental aids are available on the market, but some of them can be made yourself. However, you should remember to design the teaching situation in such a way as to make it easier for the child to concentrate and learn. The tasks given to the child must be clear, transparent and take into account one, improved difficulty. Materials for independent work should include error control, i.e., specific markings that exclude the need to involve adults. Individual exercises should be adapted to the child's level, taking into account the principle of grading difficulty. When working with younger children, it is worth remembering about physical and motor involvement to meet their motor needs. The presented exercise can be repeated many times, taking into account various variants (Guz, 2006, p. 20). Children working with Montessori materials often show great interest, concentration and involvement in a given activity, which is called attention polarization. Thanks to this special concentration and long-term repetition of a given task, children are able to acquire the practiced skills without any noticeable effort.

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