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Neuropsychological maturity to learn

Reaching **neuropsychological maturity to learn** means obtaining a proper level of the maturity of the central nervous system (the CNS), which conditions the correct course of psychological and motoric processes, participating in learning. Maturing of the central nervous system is a dynamic process, involving the correct development of cells, forming connections between them and between brain structures, forming proper myelin on neural tracts at the right time, as well as the correct development of the primary reflexes and postural and sensory integration.

It is formed over several years – one might say that it begins in the period of foetal life and lasts for many years later, even during the school period. A different picture of neuropsychological maturity to learn will be observed in the case of a 6–7-year-old child, and a different one in the case of an adolescent, when abstract thinking is developing; yet another will be observed in the case of students. Maturity of this kind varies at every stage of psychomotor development, dependent on maturing of the central nervous system and forming connections between neuron cells and various structures of the brain. The more nerve endings and synapses are formed by a nerve cell, the more synaptic connections there are, and the stronger and more lasting the transmission of a nerve impulse is. Thus, teaching interpreted in a neuropsychological manner consists in forming new connections between nerve cells and strengthening them by means of manifold repetition.

For a child to reach a certain level of neuropsychological maturity to learn, the level of intelligence and thinking must be developed sufficiently. This depends, among others, on the rapidity of travelling of nerve impulses in cells and the strength of connections between various structures of the brain, particularly the frontal lobes. What also matters is environmental conditions, such as friendly atmosphere in the family and creating situations in which a child's needs may be fulfilled. Neuropsychological maturity to learn will be reached when, at the CNS level, a sufficient number of nerve connections between nerve cells and their structures controlling neural processes exist, and when they are characterized by proper strength, duration and rapidity of the impulse transmission.

Some emphasize the significance of the properly functioning vestibular system for a child's development. This system is the first to develop and influences all the others. It also has a major impact on the development of the Moro reflex, the tonic vagal reflex, the asymmetric tonic neck reflex and the vestibular-oculomotor reflex. It is the foundation of correct sensory integration, and is located in the inner ear and connected directly with the cochlea, in which auditory receptors are found. This small structure (the size of a rice grain) has extremely important functions. According to J. Ayres (1986), this system is the most important one of all, and influences (through numerous neural connections) the functioning of the other ones. According to St. Konturek (1998), the activities of this system are closely connected with other senses, particularly sense of vision, proprioceptors of muscles and joints, touch and pressure receptors.

"The properly developed vestibular system facilitates coping with the problem of gravitation, which gives a good sense of centre in space, in time, in movement, the sense of depth or the sense of self-awareness. It is like a core from which everything begins" (Goddard 2004: 83).

The vestibular system consists of the osseous labyrinth, which constitutes the osseous foundation of the membranous labyrinth and is made up of **three semi-circular channels as well as the utricle and saccule**. In the system, there is a liquid called endolymph. Semi-circular channels – frontal, posterior and lateral – are in mutually perpendicular positions and thanks to that receive turning movements of the body in a different positioning. Thus, they are adapted to detect angular (or rotative) acceleration. The utricle, in turn, is located beyond the saccule; both of these organs are the receptors of linear accelerations. The utricle

reacts to horizontal linear acceleration, e.g. during accelerating or braking in a car. If stimulations are processed incorrectly, car sickness of different severity appears. The saccule receives vertical linear stimulation and reads the earth gravitation field. Receiving stimulation from the gravity field is unconscious. The labyrinth, along with the cochlea, is a paired organ; thus, it is located in the left and the right ear, and are positioned in mirror reflection to each other. Therefore endolymph circulates in opposite directions in the semicircular channels of the left and right labyrinth. This fact makes it possible to identify the direction of rotations (Ciechanowicz--Lewkowicz 2005: 95). Stimulation from the vestibular system is conducted by the vestibular-cochlear nerve VIII mainly to the vestibular nuclei and to other places in the CNS. It is connected with several brain structures, and because of this, it influences the functioning of the entire human organism.

Most numerous connections of the vestibular system are those with the vestibular nuclei. They are varied and complex (Makowski 1998: 51–84), and include connections with the motor nuclei of eyeballs in the form of the vestibular-oculomotor tract, with the nuclei of the cerebellum, with reticular formation and with the thalamus and the cerebral cortex. Through its connection with the spinal cord, the vestibular system influences various motor mechanisms of the spinal cord, modulates myotonus, influences body balance and ensures reflex reactions which accompany active movements. In turn, connections with the cerebellum have an impact on the regulation of tonus of the muscles ensuring the vertical body posture, programme rapid movements, coordinate body posture and influence the ability to fixate eyesight upon a given point while performing a movement. The next connection, the one with the reticular formation, helps influence vegetative parasympathetic centres connected with the nerve nuclei III, VII, IX and X and the centres regulating functioning of the heart and breathing. There are also connections with the thalamus, through which emotions are influenced. This system is also connected with cerebral cortex in parietal and temporal lobes, and thus ensures conscious spatial orientation. Apart from the connection between the vestibular system and vestibular nuclei, there are also direct connections with the reticular system and the cerebellum, thanks to which an immediate reaction to a current stimulation, e.g. rapid correction of movements, takes place.

The vestibular system, along with the cochlea, an organ of hearing, develop very early and constitute the so-called static-auditory organ.

Through close anatomical connections and the common **vestibular--cochlear nerve VIII**, they exert a strong influence on the organ of hearing. Incorrect functioning of this system interferes with the auditory system. A child may thus have problems with various sounds, and hence – linguistic difficulties.

According to Hardy (Bień, Kukwa 1998: 30), the saccule, i.e. part of the vestibular system, apart from the radicles of the vestibular nerve, receives innervation from the cochlear part as well. These anatomical connections cause mutual interactions between the organs. What is also worth paying attention to is the connection between the vestibular and oculomotor muscles, responsible for the vestibular-oculomotor and the optical-oculomotor reflex. Thanks to these connections, fixation of eyesight upon a point during head movement occurs, and spatial orientation is possible (ibidem: 110).

The vestibular system also influences the development of the early-childhood reflexes. Research in the field of the development of movement activities and reflexes, understood as constant ingredients of the development of a child's movement, was pioneered by Rudolf Magnus (Czochańska 1995: 41). A reflex, according to J. Czochańska (1985: 155), should be interpreted more broadly, and thus not as an unchanging stereotypical reaction to a stimulus active at the moment, but as part of a child's motor development. These reflexes shape a certain movement pattern and thanks to it, in the first and second year of a child's life, they are developed similarly. Rudolf Magnus called the reflexive reactions with which a child is born and which help maintain the proper body positioning **the postural reflexes**, and the other ones, serving to maintain a vertical body posture, **the straightening reflexes**. The former remain observable in the first six months of life, while the latter are formed in the second six months of life. Thanks to them, a child becomes quadrupedal, and later on – bipedal. In the second six months of life, **the balancing reflexes** are also developed; this process begins in the period between the 6th and 8th month of life, and should be fully completed between the 18th and 20th month of a child's life. The vestibular system and neck receptors participate in forming the postural and the straightening reflexes (ibidem: 154).

Apart from posture and straightening group, several tens of other motor automatisms have been described. However, according to J. Czochańska (ibidem: 53–60) and other authors, only some of them have clinical

importance. It is possible that they have not yet been fully researched. They include: the Moro reflex, the hand grasp reflex, the foot grasp reflex, the sucking reflex, and the seeking reflex.

The straightening reflexes help overcome the force of gravity, are the basis of gradual verticalization, and initiate the development of bipedality. Gradually, in the course of maturing of the nervous system, the straightening reflexes weaken and are virtually integrated by the fifth year of life. They are replaced by balancing reactions, which appear after the 6–8 month of life, and express cooperation of the cortex, subcortical nuclei and cerebellum. The function of the balancing reactions consists in positioning the body properly in relation to the centre of gravity.

As it can be seen, until recently the role of the early childhood reflexes was treated as that of a certain movement pattern, which appears at a proper time and is supposed to train a movement scheme. The role of reflexes was interpreted solely as practising a certain movement pattern, thanks to which a child may acquire vertical body position.

P. Blythe and S. Goddard-Blythe (2004; 2006) have significantly extended the meaning of the infantile reflexes and shown their influence on various psychological functions and on learning. Several-year long research conducted by these authors and other scientists shows that a given reflex opens and activates neural tracts, conducting an impulse to various brain structures. That is why their concept includes an assumption that if the primary reflexes (namely those with which a child is born and which are gradually integrated by the sixth month of life) survive beyond the physiological period of being observable, they will interrupt psychophysical development. It is, then, called **a perennial reflex**. In the concept of these authors, such a reflex causes functional rather than organic disturbances. Differentiating between these two meanings is important because in medical nomenclature a perennial reflex is formed by organic damage to the brain (Michałowicz 2000). Therefore, the author of this article suggests introducing the term "**trace form**" of a given perennial reflex for functional disturbances, e.g. the trace form of the Moro reflex or the trace form of a perennial Moro reflex. Such a shape of a perennial reflex does not cause organic interruptions and intensity of the remains is small, and thus it is a trace.

The primary reflexes, according to P. Blythe and S. Goddard, include:

The Moro reflex – formed in the 9th–12th week of foetal life and developed throughout the period of pregnancy. It is integrated between the 2nd and 4th month of a child's life. It appears as a response to a sudden stimulus, such as a noise, a sudden movement or a change of light in the field of view, stimulation of labyrinth by a change of head position, pain, change of temperature or abrupt movements of another person. Reaction of a newborn involves abrupt abduction of hands and bending the head, along with bending legs and making a loud scream; next, the hands gradually return to the close position. Abducting them facilitates abrupt inspiration, and bringing into the previous position – an exhalation. The entire organism is abruptly stimulated. The Moro reflex is an unintentional reaction to a danger. It acts like the earliest form of the fight or flight reaction, appearing in the later periods of life. The role of the reflex is to alert, wake up and call for help. The trace form of the Moro reflex causes exaggerated reactions to being surprised (oversensitivity of one of the sensory channels). A child has an elevated level of fear, tends to overreact and seems to be immature emotionally or overactive psychomotorically. It may behave in one of the two following ways:

1. timidly, with reservation and an elevated fear level, showing inclination to neuroses;
2. aggressively, irritably and easily losing its temper.

The trace form of the perennial Moro reflex influences emotional functioning, causes lack of stimuli selection and increases adrenaline and cortisol production, lowering the organism's immunity. It, thus, results in being infection- and alergy-prone. Frequently, a child is oversensitive to loud sounds or only some sounds because its trace form causes interruption of the development of the stirrup muscle in the middle ear. This muscle, when a loud noise is heard, moves the auditory ossicles away from the tympanic membrane. It also influences the ability to fixate eyes upon a chosen figure among other figures in the field of view. It develops as the first reflex and because of this, it may interrupt the development of the following ones.

The palmar reflex (i.e. the palmar grasp) is formed in the 11th week of pregnancy, and integrated during the 3rd month of life. Its feature is palm grasp movement. A gentle touch or pressure on the palm of a newborn causes clenching fingers. In the period between the 4th and 6th months of life, this reaction starts evolving into the reaction of grasp by a thumb and

an index finger. The trace form of the palmar reflex causes: awkwardness, hindering the development of independent thumb and fingers movement, destroying grasp, which causes poor handwriting, and through Babkin loop (a neurological connection between the palmar and sucking reflex) interrupts articulation. The children, experiencing this problem, move their tongue and lips while writing and drawing. Oversensitivity of palms may also be observed.

The asymmetrical neck tonic reflex (ANTR) appears in the 18th week of foetal life and is gradually integrated by the 6th month of a child's life. It consists in a child turning its head to the side and at the same time causes straightening of the hand and leg on the same side in the direction of which the head has been turned, as well as bending limbs on the opposite side. During foetal life, this reflex develops kicking movements and movement of a child in the mother's womb, develops muscular tonus and stimulates the vestibular system. This reflex ought to be fully developed in the period of childbirth because it participates in it actively, and this is so because a child's movement and turning cooperates with uterus contractions. S. Goddard and others claim that it does not only play a major part in childbirth, but is even strengthened by this event. In the period of infancy, this reflex increases myotonus of the extensors, in turn practising each half of the body and lateral movements, forming the basis of reaching movement. What is also ascribed to it is the development of motor-optical coordination, which will make it possible for a child to touch objects under the control of sight in the future.

The trace remain of the ANTR hinders alternating movement during crawling and walking on all fours, which has a negative influence on motor coordination, integration of the vestibular system with other senses and forming too weak connections between the right and left brain hemisphere, which are located in *corpus callosum*. The development of lateralization is weak or results in cross lateralization, which in this approach should, in my opinion, be treated as a failure to reach the proper maturity of the ANTR. What is also made difficult is following objects with the eyes, which results in dyslexia, interrupted convergence and accommodation. Handwriting is poor, and grasp incorrect; there is no automation of writing, and thus it is difficult to express thoughts in a written form.

The sucking and seeking reflex appears in the 24th–28th week of foetal life, and is integrated in the 3rd–4th month of life. The trace form of the

sucking and seeking reflex causes problems in articulation and moving the tongue forward, which may result in difficulties in chewing foods and may cause dribbling, and then oversensitivity around the mouth. Through Babkin loop, it also influences manual dexterity.

The Galant reflex is formed in the 20th week of foetal life and is active no longer than until the 9th month of a child's life. It consists in bending with concavity directed towards a stimulus if lateral part of a child's torso is touched or irritated. The reflex ought to be equally intense on both sides. It also has supportive function during childbirth. The trace form of the Galant reflex results in the oversensitivity in the area of the back between the shoulder blade and hips, and thus children are reluctant to wear clothes with a belt, find chair back rests uncomfortable, keep twisting on a chair, have weak short-time memory and troubles with controlling the urine bladder. Such children frequently suffer from enuresis.

The vagal tonic reflex (VTR) is divided into: 1. the vagal tonic reflex in the upright position (posterior), 2. the vagal tonic reflex in the bending position (frontal).

The frontal reflex of this kind appears gradually during foetal life through adopting the bending position, and is integrated in approximately the 4th month of life. The other one, in turn, appears when the child enters the birth canal and is fully present after childbirth; it is gradually integrated between the 7th week and the 3rd year of life. Automatism of the first reflex means that when a child bends the head, it results in bending the arms and legs as well. The automatism of the other one results in a child bending the head to the back below the spinal cord line with simultaneous extension of arms and legs. Action of this reflex is complex. It certainly influences the proper positioning of myotonus in the body. J. Ayres points, in turn, at disturbances in sensing gravitational stability, resulting in the lack of ability to assess space (up-down, right-left, front-back), depth, distance and rapidity. Lengthening action of this reflex slows down the development of head stabilization. The weak control of the head muscles results in eye activity disturbance and proprioception. It will also make crawling and walking on all fours more difficult. A non-integrated tonic frontal vagal reflex will make it difficult to form the proper body posture. The child will show tendency to stoop, bend the head forward, and bend the knees. Movements while running and walking will be less harmonious and more

rigid. Weak balance of the entire body causes fear of heights. An ability to form sequences and time sense are also disturbed.

The tonic posterior vagal reflex, apart from the symptoms mentioned above, may cause a tendency to walk on one's toes and rigid jerking movements due to the domination of extensors and weak organizational skills.

The trace form of this reflex interrupts myotonus of flexors and extensors. A child may stoop or become excessively rigid, performing jerking movements and walking on its toes. The disturbed sense of balance and car sickness are observable because this reflex is connected with the labyrinth. A child may suffer from weakened visual perception (figure-ground) and problems with spatial orientation, time sense, forming sequences, as well as weak organizational skills. Such children often experience fear of heights as well.

The symmetrical tonic neck reflex (STNR) is a temporary reflex which appears in the 6th–9th month of life and is integrated in the 9th–11th month of life. It facilitates opposing forces of gravitation by lifting the body on hands and knees from the lying position on the abdomen. It also facilitates integrating the VTR. It separates the body into halves along the central line, making it easier for upper and lower pairs of the limbs to move independently of each other. It practices looking further in the distance and makes it possible to follow an object approaching a child.

A trace form of the STNR influences forming an improper body posture. A child stoops during a lesson and while writing, and excessively lowers the head and bends upper limbs; it results in the so-called "writing with a nose". At the end of the lesson, the child is tired, which is reflected in the necessity to support its head with the elbows, placed on the bench. Frequently, it moves awkwardly, experiences problems in P.E. lessons and has weak coordination of hand and eye movements. It cannot participate in ball games because it cannot follow the ball while it is moving. The STNR may also cause excessive motor overmobility and disturbance of concentration due to difficulties in sitting in one position at a bench. A child, thus, begins to turn and wriggle, which prevents it from concentrating on a lesson.

The Babiński reflex appears approximately in the first week of life and is slowly integrated by the second year of life, which is connected with maturing of the corticospinal tract. Slight trembling of the external edge of

the feet causes dorsal bending of the big toe and spreading toes. This reflex slows down the plantar reflex and helps a child in crawling by placing toes on the surface and pushing with its feet.

The plantar reflex is a primary grasp reflex. It is observed until the 7th–9th month of a child's life. It appears after slightly pressing the foot soles, after which there appears the movement of bending and grasping with toes. The function of this reflex is not entirely clear. Lengthened presence of this reflex may influence forming a tendency to bend toes in the standing position, which will result in the lack of feeling of safety and uncertainty in the field of gravity. It also may, through the nervous loop connecting the palmar reflex and the plantar reflex, interfere with manual development.

When the primary reflexes begin to disappear, the postural ones take their place. What the authors include into this group is the straightening reflexes and balancing reactions. They do not disappear, and remain in existence throughout the entire life. The function of the postural reflexes is complex.

For a child to reach neuropsychological maturity to learn correctly, sensory integration should also occur. **Sensory integration** is a process owing to which the brain receives information from all senses, segregates it, recognizes, then integrates with other information and with previous experience, and responds to the acting stimuli with an adequate reaction. The theoretical basis, diagnosis and therapy were formed by J. Ayres (1986). She was the first to discover a major role of the vestibular system in psychomotor development. She also differentiated four early childhood reflexes: the Moro reflex, the asymmetrical tonic neck reflex, the tonic neck reflex and the symmetrical tonic neck reflex, which have a significant influence on learning, and their survival beyond physiological period of being observable causes the interruption of sensory integration.

J. Ayres described in detail deficiencies of sensory integration, occurring in children with learning difficulties. They include disturbances in registering and processing stimuli, mainly within the three fundamental sensory systems: **vestibular**, **proprioceptive and tactile**.

Their symptoms are dysfunctions in the field of postural, defensive and balancing reactions, ocular-motor and acoustic functions, myotonus, and apart from that – an incorrect body pattern, difficulties in movement planning, dysfunctions in bilateral motor coordination and sequentiality. These disturbances result in difficulties in learning to read, lowered level of

graphic skills, mistakes while writing, which consist in substituting similar letters, but positioned differently in space, e.g. “b-d”, “p-b”, “p-g” and so on, difficulties in coping from the board, trouble in differentiating between directions (right – left), or weaker bilateral motor coordination. These typical difficulties are frequently accompanied by emotional disturbances, difficulties in concentration and psychomotor oversensitivity as well.

The process of development integration takes place at several levels. J. Ayres emphasizes that adequate integration is the basis of normal learning. Highly complex perception processes such as optic or auditory perception, speech, ability to read and write are dependent on the integrative processes in terms of basic sensual systems, i.e. receptive, vestibular, kinaesthetic, optic and acoustic.

J. Ayres emphasizes the importance of vestibular nuclei located in the brain stem. In the vestibular nuclei, all the information coming from muscles, tendons, skin, hearing and eyesight receptors is processed.

It cooperates closely with the motor system. Deficiencies of these systems in connection with deficiencies of proprioception result in **dyspraxia**, i.e. disturbances of movement planning and performing. A child suffering from dyspraxia moves awkwardly, frequently trips and keeps jostling objects. Dyspraxia may differ in intensity, from small to significant. Sometimes, it causes difficulties in precise movements, e.g. dressing up, writing and DIY. In other cases, it affects gross motorics, e.g. jumping, climbing, running, etc.

Another system important in sensory integration is the **tactile system**. Touch is a sense developing most early and influencing the proper emotional development of a child. Receptors of this system are located in the skin, where they receive sensations of slight and deep touch, pressure, vibration, warmth, cold and pain. Emotional sensations reach the brain from all over the skin, the largest body organ of our body, and lead to virtually all other areas of the brain, be it directly, or indirectly, travelling through the reticular formation. Sensory impulses are conducted in two ways along the nerve to the brain. One of them is connected with the proprioceptive kinaesthetic system, while the other one conducts pain and temperature sensations. It reaches the reticular formation and exerts major influence on its functioning. Tactile information is important for human motor reactions. In the cerebral cortex, receptive and motor fields are next

to each other, forming the belt, frequently called sensory-motor or somato--sensory cortex.

Touch is extremely important in mastering the sensory-motor activities and praxis. It also has a major influence on the development of eyesight and hearing. It also has niejasne that deficiencies in the ability to differentiate emotionally correlate with reading difficulties.

Children with lowered tactile perception level suffer from disturbances in sensory integration. The central nervous system localizes, segregates and manages the provided information. When the information reaching the brain is correctly integrated, it can be used to formulate proper perception, behaviour, or to learn (Maas 1998; Ayres 1986; Przyrowski 2000; Grzywniak 2006).

In every sensory system, there may occur **oversensitivity** and **undersensitivity**. Oversensitivity is observed when the threshold of necessary stimulation is lowered and not much strength and a small number of stimuli are enough to activate a given system. Undersensitivity is observed when the threshold of necessary stimulation is elevated and a lot of strength and a large number of stimuli are needed in order to stimulate a given system.

The symptoms of oversensitivity in the vestibular system include: reluctance to swinging, going on a merry-go-round, climbing gym ladders and car sickness. Undersensitivity**,** in turn, is manifested by a strong tendency to swinging, turning round, riding down a slide, and always wanting to keep playing in this way. He child does not feel fear of real dangers, which may lead to dangerous situations. Other dysfunctions of this system include **gravitational uncertainty**, **movement intolerance** and **postural-ocular disturbances**. Among symptoms typical of children with **gravitational uncertainty**, there are: fear of falling and heights, reluctance to swing, climb gym ladders, go down a slide, jump from the higher to lower surfaces, make somersaults, travel by car rapidly; a child is also afraid of abrupt breaking and displays dislike of free-time activities in which legs must be separated from the surface. In turn, movement intolerance consists in a child's intolerance of all accelerated movements, such as swinging, going by bus, going on a merry-go-round and so on.

It is also in the tactile system that oversensitivity occurs. This is manifested by reluctance to be touched, avoiding certain textures of fabric (e.g. a child is oversensitive to woollen fabrics and clothes labels and does not like touching any clothes), and possibly also the physical

proximity of other people. Most frequently, it is only observed on certain body parts, namely e.g. the head, palms and abdomen. This is caused by misprocessed nerve impulses of the tactile system, which may as well cause oversensitivity and feeling of discomfort. **Undersensitivity**, in turn, is constant willingness to have skin receptors stimulated, however, with a touch that must be stronger by far. Thus, a child provokes situations in which it could experience a stronger touch, i.e. being hit. It may, then, appear to be aggressive and truculent. It is so because undersensitivity is observed, among others, in children with behaviour disturbances and with autism. Yet another system, which according to J. Ayres influences the development of the others, is the **deep sensation system**, also called **proprioceptive**. These receptors are located in muscles, tendons and joint capsules. Proper functioning of this system is necessary for the development of reflexes, planning and making movements, regulating myotonus and coordination. Disturbances of the processing of nerve impulses coming from this system result in dyspraxia, dysgraphia and postural-ocular disturbances.

Summary

In this paper, I meant to present the new term, neuropsychological maturity to learn. Introducing this term in the light of new expertise in the field of neurobiology and neuropsychology is justified because it emphasises the importance of forming connections between nerve cells and periods of life in which forming of such connections needs to occur. If they are weak and not numerous enough, transmission of an impulse is hindered. In this case, a child's behaviour will display certain difficulties in functioning. Actual symptoms will depend on the part of the CNS in which the transmission of the nerve impulse is weaker, e.g. weak connections of certain structures in the limbic system with frontal lobes cause the domination of emotional behaviour over rational behaviour.

Thus, noticing the entire set of symptoms, which occur along with difficulties in learning is important, because this will allow for choosing the adequate therapeutic method. I would like to attract attention to two such methods and their theoretical basis: the A.J. Ayres sensory integration method and the method of development of the early childhood reflexes according to P. Blytha and S. Goddard. J. Ayres' method is based upon the

assumption that proper physical exercise and stimulation of the vestibular system allows for the development of the postural reflexes and facilitates the integration of primary reflexes. "If, however, activity of the primary reflexes is too strong, the stimulation with the postural reflexes in itself rarely results in the overall improvement of coordination of small motorics, functioning of the oculomotor system, processing visual information and academic achievements" (Goddard 2005: 65). In order to integrate the primary reflexes, a special relevant programme should be applied, consisting in repeating movements which are performed by a child since birth in accordance to the stages of its development.

Thus, for a child to be able to reach neuropsychological maturity to learn, its CNS has to form a proper number of nerve connections between the structures of the brain and transmitting a nerve impulse must take place with proper strength and rapidity. Forming networks of nerve connections between nerve cells and the structures of the brain is nearly a life-long phenomenon, but it is the most intensive in sensitive periods and in childhood (Blakemore, Frith 2008).

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