ACTIVATING THE BRAIN WITH MOVEMENT AS A TOOL FOR LEARNING

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Abstract: Movement is necessary for learning. Integrative movement anchors information and new emotional experiences in the nervous system. The relationship between motor activity, mainly movement for learning that occurs in both parts of the brain and in the neurons that assemble the nervous system. Movement, and primarily coordinated movement, stimulates the creation of neurotrophins. In this context, the findings indicate that movement facilitates the development of many more blood vessels that carry to the brain water, oxygen, and nutrients vital to its functioning. The findings reinforce the importance of physical education, movement, and play in the improvement of cognition.

Keywords: *Movement, nervous system, physical education, play*

Learning begins in the mother's womb. The infant has the ability to function in movement, accompanied by the drive to move in space, to straighten up, to stand, and to walk. The ability to know the body and the space is strengthened by the movement activity. An infant move in different directions, up and down, forward and backward, moving away and coming closer, and moving high and low and in every direction. The infant plays with different objects and use a broad variety of movement at the time of his actions. The play with toys enriches the variety of his activity. The infant learns to play, to disassemble and to build, to throw and to catch, to communicate with the environment, to speak, and

over the years he draws, writes, reads, and solves simple and complicated problems (Shimoni, 2006).

The desire and decision of the infant to move, to play, and to communicate are the main motives in the developmental process. The environment that responds to him reinforces the process (Shimoni, 2006).

There is unanimity in opinions regarding the fact that already as an infant the ability of differentiation exists, since the adult has a place and role in helping the infant/toddler develop the mathematical knowledge basis from the beginning. Piaget addressed the sensory-motor stage, birth to two years. According to him, in this stage the child learns to know the world through the senses and the motor activity. The events are recorded separately and in an isolated manner, without reversals and continuity. The child focuses on details and not on the relationship between the items. The child differentiates between what is the same and what is different in general situations such as many and few but finds it difficult to compare in the intermediate situations. The child still does not have a mathematical language of concepts that enables the expression of quantities in an abstract manner and from the view of relations, for instance, more than or less than, and has still not acquired the preservation of quantity (Bruce& Alan 2006).

The abilities of classification and the composition of sequences are accepted and commonly found in the kindergartens. It is reasonable to assume that this is the result of the didactic translation of Piaget's theory that came to the kindergarten in many places around the world. Piaget argued that the basis for the perception of the concept of the number is the understanding of the logical principles, classification and seriation, upon which the number is based. The ability to count is one of the basic skills acquired in the kindergarten in social contexts meaningful to children. According to the nativist cognitive approach, the principles of counting are innate principles, and only the ability to name them

develops with age. When the internal component is fully developed, the environment constitutes merely a trigger. However, when the internal component is only a skeletal structure, undetailed, the environment contributes to the shaping in the brain through interaction between the mind and the physical and socio-cultural environment (Kamiloff-Smith, 1992).

Research findings in brain studies indicate the relationship between motoric activity and enjoyment, a relationship that influences directly the promotion of the learning (Narvaez, Panksepp, Schore, Gleason 2013). One of the ways of engaging in movement in learning is the engagement in exercises of relaxation or meditation in an everyday manner for a few minutes, before the learning. These exercises are vital to the clarity of thought, the alleviation of tensions, and to enjoyment that contributes to learning.

These findings are supported by brain studies, which discuss the relationship between movement and emotion. From a physiological perspective, there is a direct relationship between the cerebellum, which is responsible for muscular activity, and the centers of pleasure in the emotional system, the limbic system. The sensory-motor experiences are directly sent from the cerebellum to the limbic system (Jensen, 1993).

A research study (NCTM, 2000) discusses the influence of cognitive interpretations of situations on the learning experience: physical arousal caused by learning with the integration of motor activity, which is done in pleasant contexts or situations, will influence the type of emotion experienced. Therefore, the integration of movement needs to occur in positive contexts of experience (NCTM, 2000).

We can say that movement is necessary for learning. Integrative movement anchors information and new emotional experiences in the nervous system and involves and activates many of our mental abilities.

The Association of Brain Researchers determined that the relationship between motor activity, namely movement for learning that occurs both in the parts of the brain and in the neurons that constitute the nervous system. In the cerebellum nervous processes occur that are responsible not only for motor activity, but also simultaneously for memory, language, attention, emotion, and even making decisions (Jensen 2003).

Movement, and primarily coordinated movement, stimulates the creation of neurotrophins, natural substances that stimulate the growth of neurons and increase the number of nerve linkages in the brain. In this context, the findings indicate that movement facilitates the development of many more blood vessels that carry to the brain water, oxygen, and nutrients vital to its functioning, which is expressed in movement and learning. The findings reinforce the importance of physical education, movement, and play in the improvement of cognition (Jensen 2003).

Ratey (2010) describes the direct influence of the physical movements such as soccer or tennis on the ability of learning, thinking, and memory. “Evidence is accumulating that the personal ability of every person to learn new information and to remember old information improves through the biological changes in the brain, which are caused following physical activity. A certain type of physical activity can create chemical changes, which make our brain stronger, healthier, and happier. A better brain is a brain that is better equipped to think, to remember, and to learn. Physical activity such as modern dance or figure skating requires the learning of many movements and the ability to coordinate between them. People who began to undertake these activities report an improvement in the academic ability, in the memory, and in cognitive abilities. During these physical activities, the person does not exercise only the muscles but also the

brain, and especially the ability to organize motor actions and information on the continuum and the ability to access the memory banks.

The development and correction of learning skills are based on the understanding of the infinite potential of the brain. Considering the extensive development in the field of brain research in recent years, it becomes clear that the brain and the central nervous system respond exactly like muscles do to exercise. A relationship was found between balance and learning disability.

The brain of young children of kindergarten age develops significantly because of the more complex activities than because of learning through simple activities. The experiences and learning in the kindergarten influence the structure and organization of the brain (Markovitz, 2007). These facts are true as a rule for early childhood and primarily for the field of mathematics. They are very importance since they indicate the window of opportunity that is open during early childhood for the significant development of the brain – and this opportunity must be seized.

The experiences and learning in early childhood influence not only the development of the brain but also the structure and organization of the brain, or in other words, the child's actions during early childhood influence the manner of organization of his brain, which will accompany him for the continuation of his life. The brain grows more through experience with complicated activities, or in other words, children can cope with complex activities and even benefit from it. Everything around us can be understood better through mathematics. It can help children understand their world (Markovitz, 2007). If we help children link between their world and mathematics, then we will enrich their learning and their development (Ministry of Education, Curriculum for Pre-Elementary Education, 2009).

Gibson, a renowned perceptual psychologist, coined the concept of 'affordance', to describe the way in which our perception is filled with

physicality. In other words, there is a deep meaning in which we experience objects through our body and not only through the eyes.

This direction was reinforced in new brain studies that show that perception is filled with physicality and that this physicality is not only a static schema found in the person's head but is also dynamic, and the person participates in it. In other words, the body is not a machine in which the person is found, but rather the body is living, vital. The body is not a mound of substance in which the person is imprisoned; it is movement, life, and these are not found in the body itself but in the body in movement, in speech. It is a part of the dialogue dance reality, in all its parts. We see our body, we think in our body, we feel in our body. The physicality is the person's support, a source for all that may develop in him, and it is the platform of childhood (Lasry, 2011).

Clements (2001) also holds that according to the findings of research studies in the field of brain studies, the engagement in mathematics in early childhood is important.

When building these skills, we use the muscles of our body and establish both neuro-muscular paths and the relationships in the cognitive paths. The learning does not occur only in our head. The active muscular expression of learning is an important component of this learning. When thinking about this idea, it is grasped as obvious, but many are still not accustomed to think about the muscles from this perspective. We tend to attribute the muscles to the body and not to the mind, but we forget that through motor express people promote and establish our understanding.

Hannaford (2008) addresses movement as a means that influences the brain. She asserts that learning exists when we encounter the world. Thinking and learning do not occur solely in the brain; the body has an active part in all the intellectual processes from the first moments of life until old age. There is

movement intelligence, and the movement influences the brain, the emotions, the physical and mental health, and especially the learning (Hannaford, 2008).

Some research studies indicate the potential of the brain and the body and their contribution to learning. Learning at first is sensory-motor and develops into complex expressions of thinking in the continuation. The process of sensory information in the brain and the motor response is the basis of learning. The body senses nurture the brain with the environmental information, through which it creates the understanding of the world. The movements, as they are more complex, organize the knowledge and facilitate better cognitive functioning (Hannaford, 2000).

Vagovic (2008) adds that for activity in movement to engage the brain and encourage learning it needs to be age-appropriate and to engage in problem solving, involve the child, and inspire in him a variety of emotions, such as enthusiasm and happiness.

Every day the person performs different and diverse activities that he has learned to perform, through experience with a natural learning process already in his first year of life. Natural learning is a continuum of processes that occur in overlapping stages and in a continuum of coordination between our limbs. Every new stage includes components of the previous stages. While the continuum of the development of learning is similar among all the children, the pace of development differs from child to child. This learning occurs through the senses that develop during the infant's first year of life and through them the infant knows to identify and link between people, objects, and so on. These sensory patterns become the basis of our information system, which updates and becomes more refined with every new experience that provides him with the context for every learning, thought, or creative work. On this sensory basis, later emotions and movements are added that will join the infinite dance of learning.

Movement is essential in the person's life and accompanies him from the moment he is born. To develop and grow, a person must be in constant movement.

The development of motor movements constitutes the basis for the development of additional areas even in infancy. As the environment is richer in diverse stimuli, the infant will respond to stimuli, will be curious, and will move his body towards them in play. The body is networked in a system of cells (the proprioceptive cells) that provide the brain with environmental information through which the infant understands his body and his relationship to space. First, the learning process is sensory-motor and later it develops into complex types of thinking. The processing of sensory information in the brain and the motor response are the foundation of learning. As we activate and stimulate our senses, feelings, and thoughts through movement, we can enrich our abilities in all fields (Denison, 1981).

Likoff and Johansen (in Lasry, 2011) who studied for many years metaphors in language reached the conclusion that most of our language is based on physical schema. Their book *The Body in the Mind* illustrates the principle.

The development of the motor abilities constitutes a basis for the development of all other areas in early childhood. Researchers in the fields of the development of the child attribute considerable importance to the movement activity of children as a significant factor in the development of the brain (Segev-Tal Galili, 2010).

The engagement of the brain in the activity in movement is central to learning (Jensen, 2004). Kinesthetic movement engages the cerebellum, the part of the brain responsible for movement (Salomon, 2002). It enables learning beyond physical learning. Since all areas of development are interrelated and influence one another, the activity in movement influences types of learning.

Activity in movement influences more than does physical fitness, since all the developmental areas – physical, social, emotional, and mental – are related to one another and influence one another. Organized movement activity in environments rich in diverse stimuli is one of the important factors in this process (Shimoni, 2006).

The movement of the body preserves arousal during the performance of the learning task. Every change in the level of arousal that occurs following change of the movement again awakens the attention to the cognitive task. The constant renewal lengthens the duration of the children's focus on the task (Shuval, 2003).

The concept of 'cognitorics' was first used by Zilber (2009) to represent the development of the cognitive abilities through tools from the field of gross motor activity. Cognitorics describes a strategy for a strategy for the integration between the cognition that is expressed in learning and motor activity, through the arousal of the emotion. Research studies in the field of the brain emphasize the importance of the creation of a relationship between movement and learning and emotion. Constant reciprocal relationships occur among these three factors (Csikszentmihaly & Sawyer, 1995; Ward & Thomas, 1995).

Brain researches show that learning that activates many senses contributes to the internalization and understanding in learning (Bahrich & Hall, 1991). Children who can learn during movement activity use also the movement senses (contact, kinesthesia, and balance), in addition to the sense of vision and hearing. In addition, learning during movement activity occurs from arousal and enjoyment (Shuval, 2005).

Learning in movement constitutes a foundation stone in the model of teaching, and it creates interest, arousal, and enjoyment in learning because it is a basic sense and need. In addition, it is a language shared by all children. When

interest and arousal are created in learning, a second way of teaching is added: the meta-cognitive direction. There is broad agreement regarding the importance of meta-cognition for the promotion of processes of learning and high order thinking abilities (Zohar, 2009). Therefore, meta-cognitive thinking is a main component in the curricula intended for the development of thinking (Ben David, 2009).

A learner with meta-cognitive ability makes intelligent use of the strategies he acquired, through transference to the learning processes and the life space and learns from high internal motivation. Between high order thinking and internal motivation, there are reciprocal relations when a high internal motivation enables the children to acquire high order thinking skills and in parallel the ability of high order thinking increase the motivation to learn (Shank, 2001; Zohar, 2009).

Brain researchers emphasize the importance of the creation of the relationship between movement, learning, and emotion. There are constant reciprocal relationships between the three (Csikszentmihaly & Sawyer, 1995; Smith, Ward, & Finke, 1995). At this point, we note that the definition links between the movement and the cognition.

The research study of Shuval (2005) discusses this point and addresses the movement that serves the process of academic learning and is undertaken as a part of activity that leads to learning. The movement constitutes a way for the illustration, clarification, and implementation of the idea.

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