

Movement and Cognitive function

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Imagine when you were learning to drive a car. You were instructed by somebody, you then focused on the task & practiced it till it became a learnt sub-conscious act. Now you just hop in your car & go without thinking because it is a learnt skill.

At birth a baby's central nervous system is immature but evolves and re-structures from physical experiences. Therefore, as a baby develops, sensory information is received and processed by a constantly molding and adapting brain. In the infant an age appropriate task is learned when sensory information has been sufficiently integrated and actions are automated. As movement control is refined and automated then more complex and flexible movement strategies are formed for desired tasks that require the highest levels of cognition. Once learnt the task does not have to be thought about anymore because it has become subconscious and automatic . Consequently the process of movement development is intimately aligned with cognitive development. In children physical activity is considered a foundational experience directing the dynamic construction of human cognitive skill.

Primitive Reflex Movement & Reactions - Nervous System Development

The baby is born with primitive reflex movement due to a specific stimulus. These involuntary primitive reflexes are not to be confused with postural reactions which occur due to body positional changes. These reflexes help the baby until they are inhibited when the child no longer needs them when it has grown & the

Central Nervous System has reached a specific developmental stage. The "primitive reflexes" are not to be seen as entities in themselves but are merely points in the developmental journey but if they are retained & not integrated into Nervous System processing this will compromise academic learning..

The extended period of neuro-development is unique to humans and allows continued refinement, expansion, and pruning of nerves and their connections in the Central Nervous System, as a task is learned.

For example:

1. The infant learns to squat & raise when playing. Later the squat is used often in tasks involving lifting & picking up objects.
2. A child reading requires both eyes tracking together to provide accurate information to the brain. The movement of each eye is controlled by muscles which are anchored by fixed points on the bones & told what to do by the Nervous System



A very important competency requiring mastery at each early stage of movement development is the organization of stable fixed physical points so a frame of reference can be achieved for the structuring of movement control.

For example, when a baby laying on its back is able to flex its hips as abdominal control is achieved, then the lower back becomes the stabilised point which then allows the muscles to pull down towards the abdomen so the baby can roll onto its side where the hip and shoulder on the same side become the stabilized point. When a baby rolls onto its stomach it is free to explore it's world further. This provides stimuli, which will facilitate further cognitive learning and progressive development. If these fixed stable points to move from are not acquired a compensatory pattern and sensory disintegration will occur resulting not only in impaired movement development but also impaired cognitive development .

Human children are unique because the fundamentals of intentionally directed movement and thought construction share common beds of neurons, which are activated by physical experiences and academic tasks ¹

As the child carries out movement tasks sensory signals are disentangled, topographically organised and amalgamated by the brain into an accurate neurological reflection of the specific stimuli that will be further processed up the hierarchical neurological chain.

This process of integrating sensory information from below the brain (Bottom Up) is the basis for many qualitative based movement programs. Pioneers of this neuroscience include Ayres J², Goddard-Blythe³. Recently a personal account & documentation of developments has been described by Arrowsmith-Young B⁴ & Doidge N⁵

The brain unifies input from the “bottom up” to process and re-structure the data into non- temporal information (ie. Not time-based) linking past experience, relevant current stimulus and task intentions into a functional and modular format for the solution to present tasks. This is what is

known as “Top Down” modulation as the learning takes place.

The style of physical activity will influence cognitive processes differently with qualitative exercise having more specific effects on cognition than quantitative exercise¹. Qualitative exercise involves low to moderate intensity activities that involve focused attention and concentration, planning and control of the movement task. Conversely quantitative exercise involves high intensity activities that have non-specific effects on cognition. For example, running around a field will increase cerebral blood flow, arousal and attentional focus except more specific tasks such as balance activities will influence neurology that influences cognition better. “It is not what you do it’s how you do it” or said another way, the quality of how the exercise/movement is performed is crucial for best cognitive results

Many practitioners use movement in programs designed to help the learning and development disabled child. These are examples of qualitative physical exercise programs, which inhibit retained primitive reflexes and integrate sensory input to the brain. The brain then can process this sensory information and refine it so that the learning of the task is developed further via neuroplastic central nervous system remodeling (“Top Down” neuroplasticity = this is how the brain is able to change to adapt to the circumstances & therefore how the task is learned to be performed). There is a constant remodeling taking place, which responds to demands imposed by the task. It is plastic two-way connection between the body and the mind, which adapts to the changing circumstance. For example, a child learning to swing on a swing or catching a ball will have to adapt to the constantly changing circumstances

Movement is a fundamental basic process of life. What is emerging is how foundational movement development

influences how our brains cognitive processes develop. Also how our cognitive function can be influenced by specific movement activities.

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