



Sensory and Motor Development

*“The Child Must Move To Learn,
Then Learn to Move, And Move To Learn Again.”*

Kephart

Whenever learning new athletic movements, there is a level of frustration that hinders growth. This is natural. A good athletic instructor sets goals, encourages practice, gives positive feedback, and provides motivation. They also help the student understand the different stages of psychomotor development making it easier and less frustrating for an individual to learn. There are three stages that an individual progresses through when learning psychomotor skills, they are the cognitive, the associative, and the autonomic.

The simultaneous development of motor skills and cognitive skills is commonly referred to as psychomotor development and it occurs with the maturation of the central nervous system (CNS).

The beginning stage is called the COGNITIVE. The cognitive is marked by awkward, slow movements that the learner is consciously trying to control. The person has to think before doing the movement. Performance is generally poor, and the person makes many errors in these slow, choppy, movements. The frustration level is high, but diligent practice allows the person to move onto the next stage of psycho-motor development.

The second stage of psychomotor development is called the ASSOCIATIVE stage. In the associative stage, one spends less time thinking about every detail and begins to associate the movement one is learning with another movement already known. This is the middle stage of psychomotor development. The movements are not yet a permanent part of the brain. They are not automatic. Movements do not become a permanent part of the brain until they are performed ten thousand times. A person in this stage must think about every movement. However, unlike the cognitive stage, the movements begin to look smoother and the student feels less awkward.

The final stage of psychomotor development is the AUTONOMOUS stage. The autonomous stage is reached when learning is almost complete, although an individual can continue to refine the skill through practice. This stage is called autonomous because the learner no longer needs to depend on the instructor for all feedback about performance. The learner has practiced the movement ten thousand or nearly ten thousand times. This is the stage where movements become spontaneous. The learner no longer has to think about the movement the mind and body become one. This is also a very dangerous stage in athletic training. There is a tendency at times to sleep walk through the movements, by allowing the mind to wander. This can produce inaccurate practice.

You can use this quick acronym to remember the four elements that enhance the learning process, M.A.R.S.—Motivation, Association, Repetition, and the use of the Senses, students will learn more effectively

What Is Sensory Integration?

The brain is truly the most amazing computer ever devised. It receives countless pieces of information from internal and external stimuli at every second. The ability to classify, organize, store, recall and utilize this information provides the basis for learning. Sensory integration is therefore described as "the organization of sensation for use" (Ayers, 1995).

Sensory processing is the organization of sensory input from the body and the environment for use. Motor performance is the actual execution of the gross and fine motor coordination.

The brain directs and processes the traffic flow of information and translates it into a language that it can understand, one that is primarily electrochemical.

Through our five primary senses, we learn and develop through interaction with our environment, and through the special senses of proprioception, nociception and the vestibular system, the brain is able to ascertain the status of the body and make relevant adjustments in relation to its environment. The vestibular system consists of two main parts - three fluid filled semi-circular canals set at right angles to each other in the middle ear, and two vestibular sacs also filled with fluid⁶.

Various receptors used by the nervous system for information gathering are found throughout the body and include:

- **Eyes – See**
- **Nose – Smell**
- **Ears – Hearing**
- **Skin – Touch**
- **Tongue – Taste**
- **Proprioception**, via proprioceptors, nerve endings for muscle tension body position and the position and movement of our joints in relation to each other (spatial awareness)
- **Nociception**, via nociceptors the sensation of pain due to physical or chemical damage to tissues
- **Vestibular system**, located in the inner ear, provides information about gravity, balance and movement

Sensations may be thought of as "food for the brain", and when they flow in an integrated manner, the brain can use those sensations to form perceptions, behaviors and learning. Without integration, the sensations cannot be 'digested' and used.

Perception involves synthesizing and assigning meaning to sensations by taking into account our expectations, our prior experiences and usually, our culture. Perceptual discrimination is based upon the child's sensory modulation and higher order cognitive processes. The primary perceptual functions to be assessed in young children include visual, auditory, and tactile discrimination. Some higher order perceptual skills include visual or auditory figure ground perception, visual-spatial relations, auditory memory, tactile localization, and stereognosis.

Movement, Learning and the Brain

The human body was designed to move, and it is our early experiences that lay the foundation of what follows.

Every movement is a sensory motor event, and movement reinforces our learning capacity - to truly store something mentally, some type of movement activity is required - either speaking out loud, writing or other physical action such as gesticulation. By putting it into 'muscular memory' it is more likely to be remembered than something simply thought about and not 'acted out'.

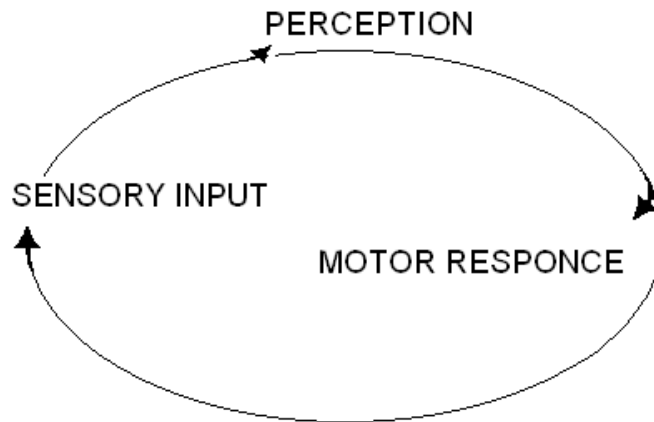
Constant sensory input and processing are required throughout life as well as in the early stages to maintain active development of neural networks within the brain. These networks are constantly being structured by dendrite formation and pruning. Every new motor activity performed generates a burst of dendritic formation creating new connections within the brain. If these new connections are not reinforced, they are literally reabsorbed by the cell body. The brain is a judicious budgeter and will not expend more than it has to, only putting energy into what it actively uses!

The old adage "use it or lose it" is truer than most people think

- The more precise the movements, the more developed the networks will become.

Perceptual Motor Development:

Integrated Process – Closed Cycle



The Sensory Experience and Movement

70% of sensory input for humans is visual, and vision therefore plays a large part in the process of learning. A reflex called the vestibulo-ocular reflex coordinates body movement with head and eye movement to provide a stable platform for vision by compensating with subtle muscle movements, or posture. Over 80% of nerve endings to muscles in the body are directly linked via proprioception and the vestibular system with motor nerves running to and from the eyes.

Hearing of course plays an important part as well, and is very dependent upon movement. The ability to orient ourselves to a sound in our environment is critical for our survival. It is one of the first complex senses that we develop in the womb.