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MULTISENSORY LEARNING IN MOTOR ACTIVITIES

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Abstract: *The topics of motor learning has incorporated in the last years information emerging from neuroscience area, explaining the mechanisms wherein human brain evolves, learns and operates.Even at early stages, in perceptual processing, areas that have been considered as sensory-specificare now viewed as responsible for multisensory modulation, activations and connectivity.*
Multisensory learning expresses a process of behavioral change, possibly by internalization and integration of sensory stimuli that lead to the formation of perceptions and perceptual-motor responses. Whether it is about expression sports or sports in which the subject competes only against space and time, sensory pathways are essential to know and understand the external conditions or the athlete's body condition at a given moment. This sensory information, known as feedback in the specialized language, is directly related to the movements performed, having as a substrate the athlete's sensations and perceptions. We think that the issue of multisensory stimulation represents an area insufficiently explored by the specialists in motor activities, but providing the opportunity to maximize the individual's behavior by using different learning styles.
Keywords: *multisensory learning, motor activity, learning styles*

Introduction

Studied from the perspective of multiple scientific disciplines, learning represents an area of analysis with conceptual designs and practical applications of great interest for the specialists in education sciences.
Generally speaking, relating to natural and social world involves a continuous multisensory stimulation. Therefore, it is likely that our brain has evolved, learned and acted in multisensory relays, information being integrated through several sensory modalities. Although during ontogenesis the individual uses several types of learning (sensory-motor, verbal, cognitive, social, motor etc.) in a spontaneous or systematic way, studies conducted in recent years highlight the growing importance of multisensory learning as a component of cognitive learning, especially in children, as a way of better coping with different environmental conditions. Thus, effective multisensory learning strategies accelerate the learning potential in various educational areas.
Studies on learning have emphasized that, when involving more sensory organs, the retention and recall of information is stronger;"we remember 20% of what we read, 30% of what we hear, 40% of what we see, 50% of what we say, 60% of what we do". It is easy to notice that if we incorporate reading, listening, seeing, saying and doing within the learning process, then the retention levels rise above 90%.[1]

In motor activities, whether we talk about physical education or sports training, the new paradigms and work methodologies emphasize the contribution of different sensory channels and the awareness of specific information in shaping and refining the sense of movement, as a prerequisite for efficiency and performance. In this context, multisensory learning expresses a process of behavioral change, possibly by internalization and integration of sensory stimuli that lead to the formation of perceptions and perceptual-motor responses (Gallahue &Donnelly,2007). Generally speaking, multisensory instruction is delivered through three primary modes: visual, auditory and sensory-motor. The last one can be further divided into fine motor - tactile and gross motor.

The current level reflected in literature

Initially considered by some authors as a modular function with different sensory modalities operating as separate and independent processes, perception is nowadays reinterpreted, based on numerous studies of neuroanatomy, electrophysiology, neuroimaging, as a result of multisensory interactions in information processing (Shimojo &Shams, 2001).
Renowned authors argue this idea by delimiting some high-level and gnozic areas (Rigal, 2002) or some association areas connected with nervous conduction pathways, which provide feedback or feed-before (Shams& Seitz, 2008). Even at early stages, in perceptual processing, areas that have been considered as sensory-specific are now viewed as responsible for multisensory

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modulation, activations and connectivity (Ghazanfar & Schroeder, 2006).For these reasons, many specialists treat sensations and perceptions together, since psychologically knowledge occurs when sensory information gets a certain direction (Epuran & Stănescu, 2010). Findings about multisensory stimulation in early brain areas might "raise a question of whether any brain regions can be fully characterized through their unisensory response properties and thus motivate learning at all processing stages as involving multisensory processes"(Ghazanfar & Schroeder, 2006).One of the studies involves changing spatial correlations between auditory and visual information, which alters the multisensory representation in the superior colliculus. Moreover, a disruption in the input to auditory cortex might result in this area, due to visual input. This evidence proves that, even in early life, the learning process and plasticity can be multisensory (Sharma, 2000). Multisensory training has positive effects upon increasing the firing rate, resetting the oscillatory neural activity and decreasing response latencies, each of these mechanisms optimizing neuroplasticity.

So, early experiences determine how our senses will interact later in our life (Wallace, Stein, 2007).

Topic addressed

Specialists say that the learning process affects the brain in two ways- by altering the existing connections, which leads to more efficient existing pathways, or by creating new ones, which lead to an increase in overall synaptic density (Hendel-Giller et al., 2011).

As far as learning also means retrieving information from the memory, the chances of finding it enhance when the number of pathways we create are more numerous. This means that the more experiences the athlete has when learning a movement, the stronger his/her ability will be to memorize and perfectly control it during the performance.

Different studies have shown that movement sonification in rowing and swimming is beneficial due to audio-motor coupling, which means that when both auditory and motor systems are activated during motor learning, the performance is displayed better afterwards, even if only the movement or the sound are produced.

How the athlete receives pertinent information to control his/her movements becomes particularly relevant in sports characterized by high technicality/complexity, in which the athlete receives additional information, useful in refining technical execution.

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The analysis of intrinsic feedback, which is related to the motor task perceived by the subject, or extrinsic feedback, additional to the task, shows that both are relevant to performing a successful element, provided that the athlete is ableto become aware, select and process the information they need and which determines the success, in terms of execution.

The study of augmentative feedback, also called additional extrinsic feedback (Epuran & Stănescu, 2010), is important from a practical perspective and for theoretical reasons, because any variable influencing motor learning must be correctly understood and applied for higher efficiency of the learning process. Actually, many learning theories are based on how the information arrives at and is processed by the neuromuscular system, in a way that must be subsequently adapted to the internal and external training conditions for the sports branch concerned.

By contrast with the intrinsic feedback, augmentative feedback provides information about the task to perform (commonly having the coach as a starting point), which is additional or increases the influence of internal feedback. For instance, information can take the form of an auditory stimulus, similar to the one warning the driver that he/she has exceeded the statutory speed– information which usually is not available in the standard equipment of a car.

We present in the following scheme the types of information used by the athlete during technical training (Schmidt, cited by Epuran&Stănescu, 2010).

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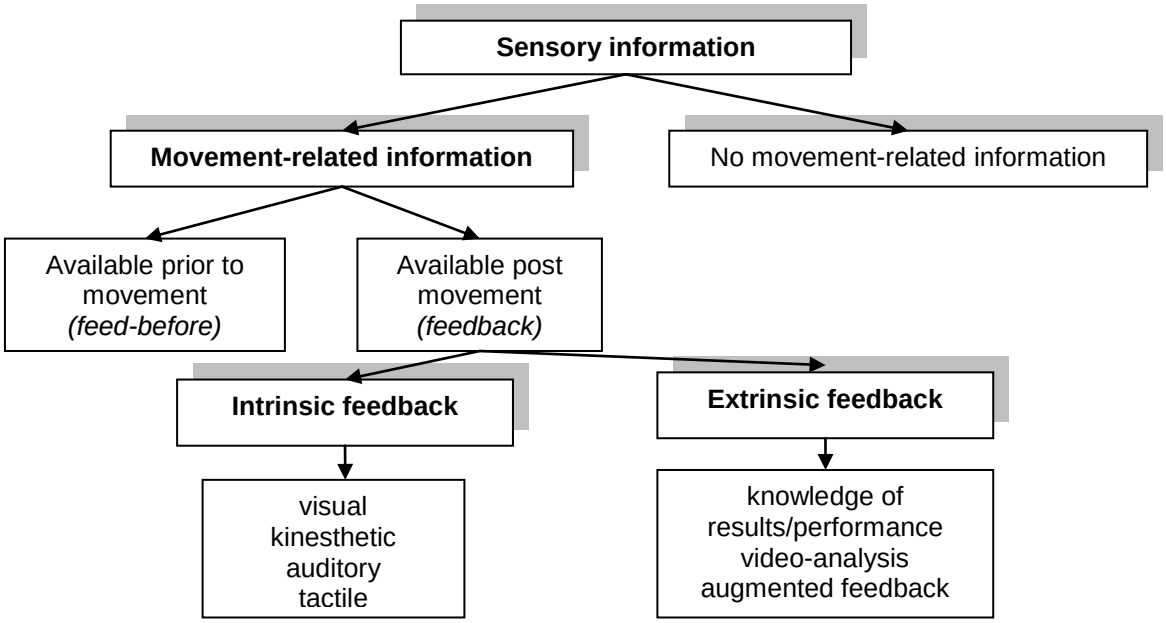

Fig.1. ***Classification of sensory information (Schmidt, 1991)***

The nature of t available information varies depending on the moment when feedback occurs; for example, in gymnastics, the feed-before contains data about the positions and movements of segments in different axes and planes during the three phases of the element, information relating to either the characteristics of the podium, which requires different "loading" when losing contact with the floor, or the optimal duration/speed of execution (Mezei, 2015).

Concurrent feedback (which occurs while performing the element), although less common due to the short durations of element execution, can relate to the awareness and rapid correction by the athlete of some positions or angles during flight and to the adoption of a correct position in the preparation for landing.

Feedback, after achieving the technical element, refers to the set of sensations and perceptions felt by the athlete during execution, which they can express, analyze and compare in discussions with their coach or teammates. This is the moment when the coach makes judgments about technical correctness, emphasizing the ideal motor sensations associated to it, or provides information about the identified execution faults.

Augmentative feedback can also be verbal, when the score is awarded after a gymnastics routine.

Without minimizing the essential role of feedback in sports training, it should be noted that the abuse of information from the coach, without a careful selection of the amount and moment to administer it, may lead to disorganization of the athlete's behavior or, even worse, to the creation of dependency, which cancels their awareness and responsibility-taking in relation to their performance in training and competitions.

Summing up, in motor activities, both children and adults approach differently the learning process, according to certain learning styles –visual, auditory and kinesthetic (Kolb, 1981; Honey &Mumford, 1982; Barbe & Milone, 1981). Consequently, coaches and physical education teachers will have to capitalize the subject's learning preferences, which can occur independently or in combination, leading to an individualized teaching/training design, as a modality to increase the athletes' performance.

Conclusions

According to recent educational and clinical studies, multisensory training enhances learning, which brings to surface the importance of multimedia educational techniques.

Authors agree that encoding, storing and retrieving information in educational settings operate better in a multisensory environment.

Even at early stages, areas that have been considered as sensory-specific are now viewed as responsible for multisensory modulation, activations and connectivity.

In motor activities, particularly those focused on performance, multisensory stimulation takes the form of complementary training sessions, which bring additional information received by the athlete in real time,

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during practice. Thus, besides the observations and corrections made by the coach, there appears instantaneous information via different sensory channels, which raises the awareness of movement and its immediate correction.

We think that the issue of multisensory stimulation represents an area insufficiently explored by the specialists in motor activities, but providing the opportunity to maximize the individual's behavior by using different learning styles.

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