Module 4. Integrative reading

Integrative reading

After completing the course readings, as a form of integration we must have some clearly defined concepts.

The most important thing to keep in mind is that motor learning and technical training are different stages. These stages are integrative and interact, they are not isolated blocks. However, they depend on different neural correlates and also require specific interventions. When we mix them, that is, when we perform what corresponds to one stage in another, we may be consolidating motor errors in movement.

We make it easier to learn, but we make training more complicated and disrupted. When we simplify, we train less; when we disrupt or complicate learning, we consolidate errors. Understanding that each stage has its different logic helps to avoid motor errors. Each stage has prescriptive application points to be applied by the coach that should not be mixed, but should be respected, in order to establish higher quality motor learning.

The technique must be at the disposal of tactical thinking; however, refining the technique frees us up space for tactical thinking and creativity. The quality of the technique conditions either by facilitating or by impairing the creative motor act.

Automatizing a trained technique allows us to free up brain space for better quality strategic tactical decisions and for motor creativity.

One of the objectives of this material was to relate neurobiology with motor learning and technique training to analyze the tools that these disciplines provide us with, in order to accelerate overcoming motor errors, to try to correct the failed effects of the movement and generate durability in these corrections.

There are 3 or 4 main phases of the motor learning process and training technique:

- Acquisition phase.
- Refinement phase.
- Stabilization phase.
- Variable readiness phase.

We say 3 or 4 main phases as we can include the variable readiness phase in the stabilization phase.

The acquisition phase begins when the individual receives the first general explanations, has visual contact with the movement and manages to execute it initially, even if this is low quality/with lots of errors.

The improvement phase is when, through repetitions, the athlete progressively eliminates the parasitic movements and defects (here correction becomes relevant).

The final phases (stabilization and variable readiness) are of particular interest to us because it is in these phases that the theory of dynamic systems and the theory of environment difficulty and disturbance, become relevant in terms of achieving quality in technical execution, despite facing all kinds of restrictions and disturbances whose design, from a methodological point of view, must have this logic. To summarize: facilitate to learn; complicate and disturb to train.

Motor errors: Motor errors are deviations from the model of ideal athletic technique, which should be corrected if they reduce the effectiveness of the motor execution.

There are those that argue that there is no ideal model for any particular activity. To assert this would be disrespectful to the professionals who have dedicated countless hours of research to the subject, based on fields of science such as Biomechanics, Bioenergetics, Anatomy, Neuroanatomy, and so on. When talking about motor errors, it is worth considering:

- What type of errors they are.
- What the possible cause for this error is.
- What the solutions might be.

Perhaps it is in this unit that we find our true role as trainers. Correcting errors is what we do regularly or at least what we try to do on a daily basis. Most teachers and technicians barely point out errors, and very few mount or structure a corrective teaching method with all the requirements that this implies. There are trainers who are experts in detecting damaged structures, motor errors, but few who can generate perceptual structures to help overcome them.

From our perspective, we object to the "new pedagogy" trend, which advocates for non-intervention. Correcting movements has been present since the dawn of humanity, and it is not synonymous with oppression or limitation of liberty.

Regarding the types of technical errors, it seems important to emphasize the following concepts:

- **Normal errors:** that is, the common mistakes that occur during any regular motor learning process, especially during the first attempts.
- **Stagnation:** these are consolidated errors, executed for years and difficult to correct. This usually occurs when the student learns well, but has been taught incorrectly. Correcting these types of errors requires a special teaching method. In these cases, you, as an athlete, automate an incorrect movement, an incorrect technique.

In addition, it is important to distinguish whether it is an error in the learning process (incomplete technique) or stagnation (consolidated error). In either case, it is important to distinguish between:

- **The "damage point"" or error origination:** the point where the error originates. It is rarely the cause, but rather a consequence of other factors.
- **The causal chain**: all those factors that, together, account for the appearance of the error.

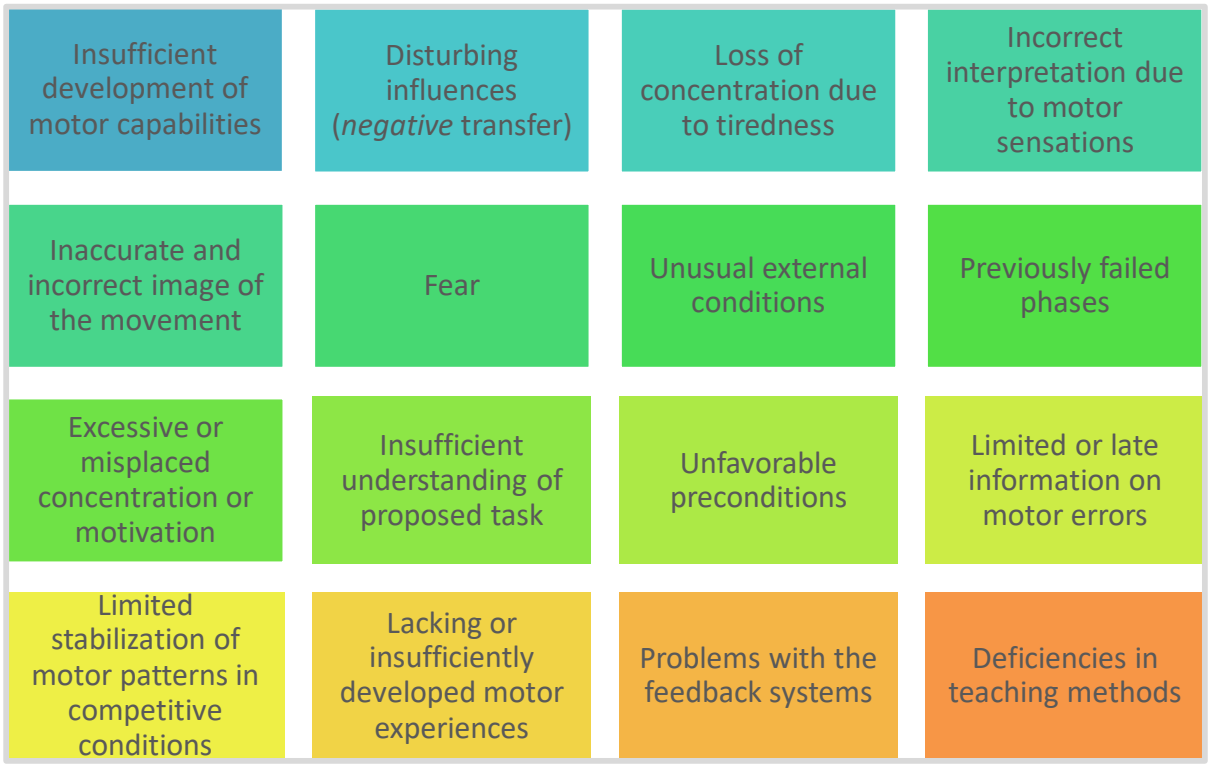
Tracking this possible explanation of the occurrence of the errors facilitates possible solutions. The error is not the cause of error; the causes may be multiple and/or combined.

Although there exist several possible causes for technical errors in the literature, we can group most errors into 4 main groups:

- Errors originating from physical deficiencies.
- Errors due to external reasons.
- Errors related to teacher limitations.
- Errors originating from mental deficiencies.

Referring to this table may help to clarify the situation, as it also includes other causes of motor errors:

Figure 1: Cause of errors



Source: Prepared by the author.

The basis of any corrective process is, inexorably, body awareness, and training in this is of utmost importance. Good body awareness is key: understanding what is happening in our body will allow us to make minor or major adjustments as necessary, and to have a correct postural alignment, which is an indispensable condition for sustaining the rest of the corrective process. Here it is important, again, to mark significant differences between two conceptually very different instances: identifying and correcting them. Many coaches only get as far as identifying them.

- **Identify:** Only indicates the error so that the subject that executes it can become aware that said fault exists, but this in and of itself is not enough to correct it.
- **Correct**: Means placing the person in a perceptual situation and applying a special teaching method.

As previously indicated, identifying means to identify the problem and communicate it, but does not involve any type of intervention.

The correction of errors signifies a more complex process and may involve the following modes:

- **Direct corrections**: The error is noted, and there is an explanation and indications given on how the student can avoid such an error.

- **Indirect corrections**: External conditions are regulated; new perceptual structures are created.

Below, we will list a series of suggestions or general recommendations for error correction, which come not just from the literature but also from classes and personal experiences:

- Observe the athlete when they execute the action.
- Compare the motor pattern executed to the ideal model.
- Recognize the error and subdivide it into principal and secondary.
- Look for the cause of the error.
- Determine the measures necessary to correct the error.
- Offer instructions and tools to correct the error.

The following themes are those we consider important when training the student:

- Detect what they are doing wrong and why.
- Know how to do it correctly (or seek advice, if you don't know).
- Indicate how to do it correctly.

As a consequence of the correction of movement errors, there is an improvement of the image thereof and, related to this, training motor perception and vision.

When thinking about correcting errors, we need to understand that our intervention will affect three structures that make up movement: the spatial, temporal and dynamic structures.

The spatial structure is regulated by the sensations we perceive from the proprioceptors and the visual analyzers, although the sense of sight is the one that provides the most information to correct spatial problems. For example: in a sport as a whole, if we don't know where to be located, we can signal that sector using different elements.

The temporal structure depends on hearing and haptic sensitivity. Often an auditory stimulus helps us to understand where to execute an action. This structure does not depend on sight, since sight does not provide succession but rather provides simultaneity. The dynamic structure refers to the expressions of force that are imprinted on movements.

Correction and perception

As mentioned previously, concentration is key after a motor act is executed, especially if the coach cannot immediately feedback corrections to the athlete. The objective of maintaining the focus on execution is to avoid losing key information to correct failures or consolidate aspects that were well-executed. For this, it is very important that the trainer indicate what the athlete has to concentrate on after completing the motor pattern. Although few authors consider this, it is one of the most important elements for learning. It is vital to understand that mistakes in the motor pattern can be addressed with words and information that coaches provide to athletes, but they must always end with a well-executed motor performance.

As professionals responsible for a student or a group, we have to understand that it is our duty to always combine corrective measures with physical exercises. We have to move past the value placed on words, the emphasis on theory for correcting errors. More than this, our trainee needs to perceive and understand the sensations of a well-executed motor pattern.

Corrective sessions

In corrective sessions, a good alternative is to use a wide variety of exercises and not just one repetitive and tiring exercise. By this we seek to associate the positive aspects of several exercises with our error, as compared to what we could perceive from a repetitive execution.

As discussed in the previous unit, stagnation could be one type of failure. The causes for these are extremely varied, but amongst them it is worth mentioning:

- Learning an inappropriate technique..
- Only receiving feedback on defects, without positive reinforcement
- Stabilizing technique in conditions very different from those of competition.
- Emotional factors.
- Continuing training with defective motor capabilities.

Some ways to address them are:

- Practicing under totally different conditions (a different pitch, pool, other elements).
- Increase sensory information so that there is over-stimulation, for example: swimming using only flippers, kicking while pushing against the wall, etc.
- Restricting information: By limiting peripheral references, we correct on the basis of cortico-cortical relationships.
- Ultra-slow executions.
- Ideomotor training, Paul Dorochenko model.

- New pace: change the speed of execution.
- Modify spatial limits: we limit the field of play and field of action.
- Substitutive movements: these are to replace a preliminary phase of the main gesture for a different movement or with a different element, which is neither very similar to the actual execution, nor very dissimilar. For example: executing the turns of a hammer throw and throwing a discus.
- Reduction of application of force: by using, for example, trampolines for doing jumps.

Correction and emotions

Here in the material we reference three fundamental steps related with: encouraging, correcting, encouraging.

This theory assumes:

- Recognizing, in the first place, improvements and acknowledging the effort made to improve, positive reinforcement;
- identifying the damaged points and correcting them with special teaching methods;
- Motivating the athlete by emphasizing the high probability of correcting and recognizing the effort.

Motivation is an indispensable factor for the performance of any activity we undertake. Therefore, as coaches we should take care not to immediately emphasize our students' errors, but rather first point out the improvement and then address the error. In addition, we must encourage pushing through barriers and always work on the correction from an optimistic point of view, in order to avoid stagnation and consolidation of errors.

Special Teaching Methods for Error Correction

When discussing motor learning or technical learning, we find that there are two distinct perspectives, both respectable and valid. One of the characteristics that differentiates both categories is the phases they are composed of.

The phases of motor learning are:

- Acquisition phase.
- Refinement phase.
- Stabilization and variable readiness phase.

If we base ourselves in technique training, the phases or levels are:

- Beginner level.
- Advanced.
- Mastery (high performance).

Acquisition phase

The acquisition phase goes from the first insecure attempts to effective, imperfect, and fluctuating executions. A teaching method proposal for this phase is to simplify or facilitate situations for execution, so that errors are not consolidated.

In this phase it is advisable to clarify the task through words and demonstrations, focusing on the most important and basic information to solve the task. No sooner is this understood, start with practical attempts without delaying physical practice with overly long descriptions or excessive visual information.

Due to a lack of kinesthetic information (resulting from little practical experience) and visual information which is unclear and limited, the athlete is conditioned to configure precise and sharp motion images. These arguments demonstrate that the use of these techniques is not the most useful for this stage of training. While we are not saying implementation is not possible, we do not recommend it as the main tool.

It is key that the executions are well executed without prolonging the action stages too much. The learning situation must be set up in such a way that the subject is able to perform the complete movement, even with errors, after a few attempts.

The teacher-trainer must:

- Create facilitating conditions.
- Offer limited explanations.
- Not over-extend time spent on technical executions.

Teaching method in the acquisition phase

It is of great importance when working with a student who wants or needs to learn a particular feature of a sport or discipline, that the teacher should establish a plan of action and generate a teaching proposal that allows the student to achieve their objectives. For the creation of this method, the teacher should take into account several aspects: the objective, material resources, the context, competence dates, the level of the student's training, etc.

The predominant methodical measure in the beginner's technical training is "developmental practice" (Martin 1977: 223) under "simplified conditions" (Grosser and Neumaier, 1986, p.110).

The different possibilities for facilitated conditions according to Manfred Grosser are plotted below.

Figure 2: Facilitated conditions

Source: Prepared by the author.

Refinement phase

As the name suggests, in this phase the aim is to perfect the technique. Unlike the previous stage, from the overall execution and the big picture we move on to the progressive fixing of errors and final adjustment of the movement, promoting the correct final form. Motor practice is mainly based on repetition. The process needs to be repeated with general corrective measures and other resources, without abrupt use of disturbances that do not allow objectives to be achieved. The main features of the refinement phase are detailed below:

- Capacity to complete tasks.
- Quality of execution.
- Motor sensations.
- Images of movement.
- Direction and regulation.

Some of the objectives of the refinement phase:

Table 1: Refinement phase

Objectives	Measures
Perfect the motion picture. Resistance to disturbances begins. First check in competitions.	Tasks of observation and analysis. Practice under normal conditions, introducing the first disturbances. Mental training.

Source: Prepared by the author.

We could say that the highest objective of this stage is to eliminate the static and dynamic synkinesis, at the same time that we configure a clear image of the movement. In the same way, the process of fixing movement against disturbances begins gradually and progressively. The teaching method *par excellence* is the one that contributes to forging a clear image of the movement. This stage is more "mental", in the sense that it is more viable to use resources such as perceptual, ideomotor and verbal training.

In the refinement phase, the teacher undertakes to plan activities where there is a lot of possibility for varying the exercises and the apparatuses or elements to be used. Since this is the phase aimed at exploiting the possibility of combining exercises and elements, we should be quick to take advantage of this resource.

The foregoing might lead us to believe that the objective is to propose different activities in all classes, but the main objective is always quality technical execution. The number of variants and combinations can be implemented as long as it does not cause errors in technical motor patterns.

Stabilization phase

The characteristics of this stage:

- Capacity to complete tasks.
- Motor sensations.
- Images of movement.
- Direction and regulation.

The objectives of this phase are:

- To develop the capability to self-detect and self-correct errors.
- To achieve a versatile and variable readiness for the technique, whatever the complexity of the context and the circumstances.

Table 2: Stabilization phase

Objectives	Measures
Capacity of self-correction. Pregressive stabilization and automation. Adaptation to variable conditions and defining technique under extreme stressful conditions.	Focused training of motor perception and observation. Variation of conditions. Increased disturbances. Creation of stress and extreme difficulties. Mental training.

Source: Prepared by the author.

It is extremely important to emphasize that the idea that governs this progression is to generate sport-oriented motor variability. For this we can complicate motor executions in several ways:

- By varying the dimensions of the game and the rest of the external conditions.
- By implementing unstable training.
- By varying the initial position, attempting to change it to uncommon positions.
- By varying the velocity of the movement.
- By using unforeseen external forces: from traction or thrust and with different vector components.
- By intervening in the execution with mirrors: which is a visual processing challenge with greater demand on the parietal areas.
- By avoiding the use of an extremity, for example: no arm movement when running or not kicking when swimming, and similar demands.
- By restricting perceptual information: either without vision, hearing or even without haptic sensitivity.
- By working with two equal or different elements.
- By changing the weight and texture of the elements.
- By hindering the background-figure contrast.
- By stopping music and redoing the activity with precision.
- By blocking the use of the dominant eye.
- By executing with the non-dominant side of the body, among others.

The possibilities are innumerable and will be effective as long as we are creative and generate proposals that adapt to the subject and their problems. This variability proposal is based on chaos theory: everything, however stable, can collapse. The main idea is to prepare yourself to be prepared; train yourself to anticipate disorder.

Transference and interference

The development of motor capabilities is widely executed. Most of the time you learn several movements at once, often, many uncontrolled movements at once, as a product of unsystematic learning, based only on practice (Meinel and Schnabel, 2004). This can be observed especially in children's play. To better understand the relationships existing in the refinement of various motor actions, it is necessary to go deeper into the laws of the motor learning process. Among them is the problem of *transference* (Meinel y Schnabel, 2004).

In order to effectively use the positive effect of transmission, both in successive learning and in the development and simultaneous refinement of motor skills, it is necessary to discover the structural kinship between the movements of a particular sport and of different sports. This is especially true of those sports where many actions are to be learned individually. The discovery of structural kinship plays an important role not only within the same sport, but also among the movements of different sports (Meinel and Schnabel, 2004).

The learning of sports techniques requires the formation of coordinating structures that are based on the "linkage of numerous centers of distribution and coordination in the central nervous system" (Grosser and Neumaier, 1990, p.149). Through multiple functional bonds in the central nervous system (CNS), the entire motor domain is linked to a complete system (Grosser and Neumaier, 1990).

According to the type of influence of the techniques learned for new learning, this is referred to as positive or negative transference (*transfer*).

A negative transfer (interference) can be manifested in sports practice through existing motor patterns that disturb the formation of new coordinating processes and delay successful learning.

This is often observed when one has to modify something learned (modification of the technique, elimination of fixed errors). Before the formation of the new elements of the motor program, the old ones have to be eliminated. Otherwise, there may be a relapse to the original movement in the case of high loads.

Preconditions for a positive transfer (transference) are the common coordinations in corresponding movements. External similarities in the development of the movement are not decisive for this, but rather "the equality of the sensorimotor mechanisms of its coordination" (Grosser, and Neumaier, 1990, p. 151). This is why it is important to discover affinities of movements to take advantage of positive transfers as well as to find the most appropriate order of the movements that must be learned, and to assimilate different

sports-motor skills. A specific case of positive transfer is the transfer of the effect of practice from one side to the other (co-exercise, bilateral transfer). It is known that exercises practiced intensively on the right side can also be performed by the left side, although with less precision. This transfer is produced by the functional interrelationships between the two hemispheres (Grosser and Neumaier, 1990).

To sum up: it can be verified that the recognition and use of the phenomenon of positive transfer can develop the learning process with greater efficiency and shorten it. In planning technical training, the following points should be taken into account regarding the effects of transfer:

- Motor learning always has to start from the simple and basic skills of a structure and move from there to more complicated ones.
- During the development of the physical condition, those movements that allow a positive transfer to the movements belonging to the current learning process should be applied.
- Numerous previous exercises delay learning. That is why it is important to do few exercises beforehand, focusing on those that favor the transfer.
- Once a certain level of mastery has been achieved, exercise with both sides has several advantages (Grosser & Neumaier, 1990).

Multi-tasking

Multi-tasking is not a long-standing concept: in recent years we have begun to hear about this methodological possibility, the application of which corresponds almost exclusively to the final phase of technical training. Based on complexity and the theory of dynamic systems, it allows for great methodological possibilities.

It is important not to confuse this concept with that of segmental dissociation, which assumes that we can perform different motor tasks with various segments, but always from the motor point of view. Multitasking is not limited to motor tasks, but can incorporate another type of task of a specifically mental nature, such as enunciating, observing, and much more. There are also common features between the two concepts:

- Activities executed at the same time.
- Two or more motor tasks.
- Perceptual tasks, enunciation tasks, and so on, not only motor tasks, which implies enhancing motor control.

We aim to highlight conceptual differences so as not to create confusion. Here we are talking about complexity and not risk, which are not synonymous. This complexity is

sought from the simultaneous application of motor or mental tasks, which aims to enhance psycho-neuro-motor functions. In this way the process of attention and concentration is almost at maximum, in order to guarantee motor control in different and simultaneous tasks. This does not necessarily imply increasing risk levels and placing the subject in situations in which the likelihood of injury increases exponentially.

Motor tasks can be divided into 3 main groups:

a. Motor capabilities.
b. Technical motor patterns.
c. Postural tasks.

Mental tasks are divided in the following 3 ways:

1) Perceptual.
2) Mathematics.
3) Enunciation.

Hence, you can make an infinite number of combinations with your creativity respecting the logic of progression of difficulty raised.

References

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Meinel, K., y Schnabel, G. (2004). *Teoría del entrenamiento*. Barcelona: Stadium.