Module 2. Special teaching methods for error correction

Unit 2.1 Teaching method I

2.1.1 Traits of technique in the acquisition phase

When we talk about motor learning or learning a technique, we encounter two distinct perspectives, both of which are valid and respectable. One of the characteristics that differentiates both categories has to do with the phases that make them up.

If we focus on motor learning, the phases are:

- The acquisition phases.
- The refinement phases.
- The stabilization and variable readiness phases.

If we focus on technique training, the phases or levels are:

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

All of the phases of motor learning have characteristics that differentiate them. These specific characteristics can be seen based on the following categories:

1) **Capacity for performing the task:**

The less experienced our trainee, the more limited their capacity for processing information. That is, their processing channels are more easily overwhelmed, even facing a lower amount of information.

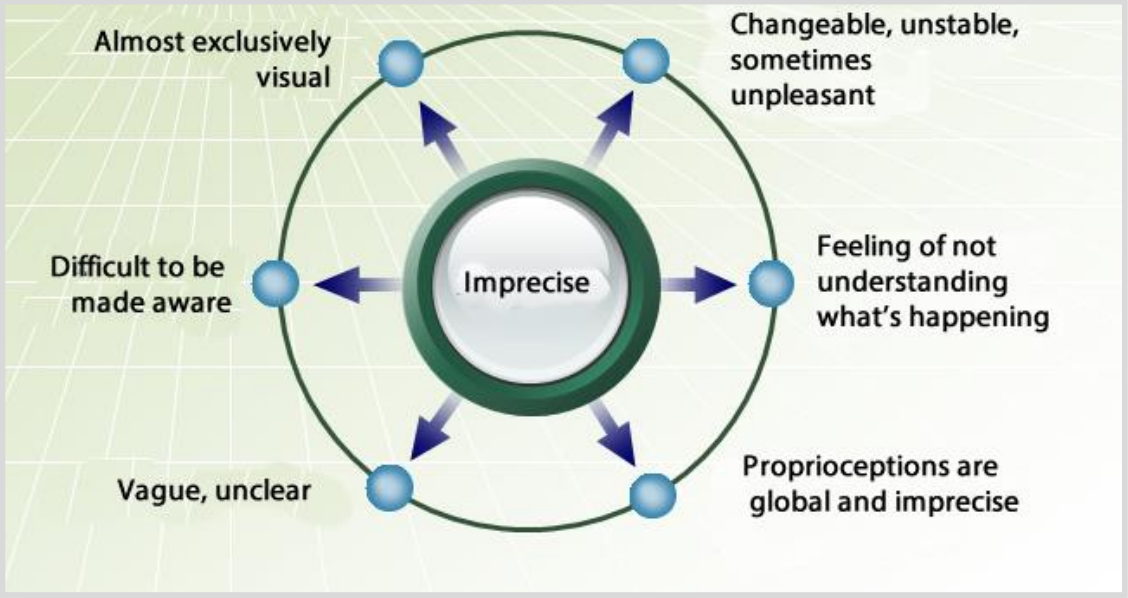
2) **Execution quality:**

Execution quality is dependent on the environment, that is, the place, the devices, materials, presence of other people, climate, positive emotional states and other considerations that could affect the execution of a task. When one or more of these conditions are not favorable, motor errors appear, which indicate that the technique is

fragile and is still in the process of acquisition. Fragility is seen, above all, when emotional conditions are adverse and often these are triggered by precise external stimuli.

In early stages, execution quality may lack fluidity, precision, cleanliness, elegance, consistency and automation (highly aware regulation). It is often accompanied by a large amount of synkinesis, both static and dynamic.

Figure 1: Imprecision in motor sensations



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- **Motor sensations**. These are often imprecise, and these imprecisions could be conditioned by:
  - **Images of movement:** just as in motor sensations, images normally show up in an imprecise manner, and visual and spatial factors predominate. The images could be incomplete and blurry. They appear and disappear in a fleeting manner. On many occasions, they are interrupted by other images unrelated to what we were trying to evoke in the first place. It is not recommended to use this tool with beginners, as its usefulness is limited.
  - **Direction and regulation:** many external factors can keep the movement from being fluid. For this reason it is advisable to not provide too much information to the athlete during the executions. Due to the low level of practice the trainee has with this new activity, they will have little capacity to regulate their muscle activations, which has repercussions on the calibration of the motor component.

Below, taking ideas from Grosser and Neumaier (1986), we will describe each one of the components in the different phases.

The acquisition phases:

- Capacity for performing the task: it is only feasible to perform under favorable conditions.
- Execution quality: the basic structure is recognizable, but lacking in fluidity, precision and consistency.
- Blurry motor sensations that are barely conscious, with visual sensations predominating.
- Blurry images of movement, visually determined, with predominant spatial qualities.
- Direction and regulation: external regulations predominate, very susceptible to interruptions.

The refinement phases:

- Capacity for performing the task: improvement under favorable conditions, lack of stability in unfavorable ones.
- Execution quality: Clear errors in unfavorable conditions.
- Motor Sensations: precise, conscious and can be verbally expressed.
- Images of Movement: Detailed, with temporal and dynamic components.
- Direction and regulation: Precise feedback, internal, errors only with disturbances.

The stabilization and variable readiness phases:

- Capacity for performing the task: high security and quality, even under adverse conditions.
- Execution quality: complete mastery can be seen in motor patterns, and high quality even with disturbances.
- Motor sensations: high precision and quality in verbal expression.
- Images of movement: there is a precise anticipated image, which can also be creative and varied.
- Direction and regulation: anticipation, stability in the result.

2.1.2 Objectives and measures of the acquisition phase

Each phase has specific objectives and particular measures to reach them.

Table 1: Objectives and measures of the acquisition phase

Objectives	Measures
Adaptation to the technical goal, formation of an overall image of movement. Have basic motor experiences. Learn the overall structure.	Demonstration-explanation. Constructive exercise under facilitated conditions.

Source: Grosser & Neumaier, 1986, p. 102.

The acquisition phase runs from the first unsteady attempts to effective executions that are imperfect and fluctuating. One didactic proposal for this phase involves simplifying or facilitating the execution situations, with the goal of not consolidating errors.

In this phase it is recommended to clarify the task using words and demonstrations, but with only the vital and basic information for the primary performance of the task; often it is not even understood, so we should focus on practical attempts, without delaying with long lectures, verbal descriptions, or excessive visual information.

The principal characteristic is the constant interaction between trainer and athlete (a rich exchange of perceptions).

The technical executions should be overall actions. There is no need to get hung up on occasional aspects, which will appear only in a small number of attempts. These technical actions should be put into practice during instances where we have the possibility to control the environmental variables that could produce distractions and generate errors.

The acquisition phase is not characterized by prioritizing theory or mental training, but rather it is focused on gathering useful kinesthetic experiences to create a motor repertoire. This will be an advantage in later instances of learning.

Due to the small amount of kinesthetic information that exists (due to the lack of practical experience) and to unclear and limited visual information, the athlete will be limited in trying to configure precise and clear images of movement. With this in mind, we can affirm that using these techniques is not the most useful during this phase of training. Although we do not deny the possibility of their implementation, we do not recommend it as a primary tool.
It is crucial that the executions be properly performed, without excessive prolongation of the action phases. The learning situation needs to be focused in such a way that the subject is able to carry out the full movement, although it may contain errors, after a few attempts.

The teacher or coach should:

- Create facilitating conditions.
- Provide few explanations.
- Not extend the technical executions for too much time.

Only in this way will our student receive the reference necessary to build a good motor program, without saturating their information processing channels.

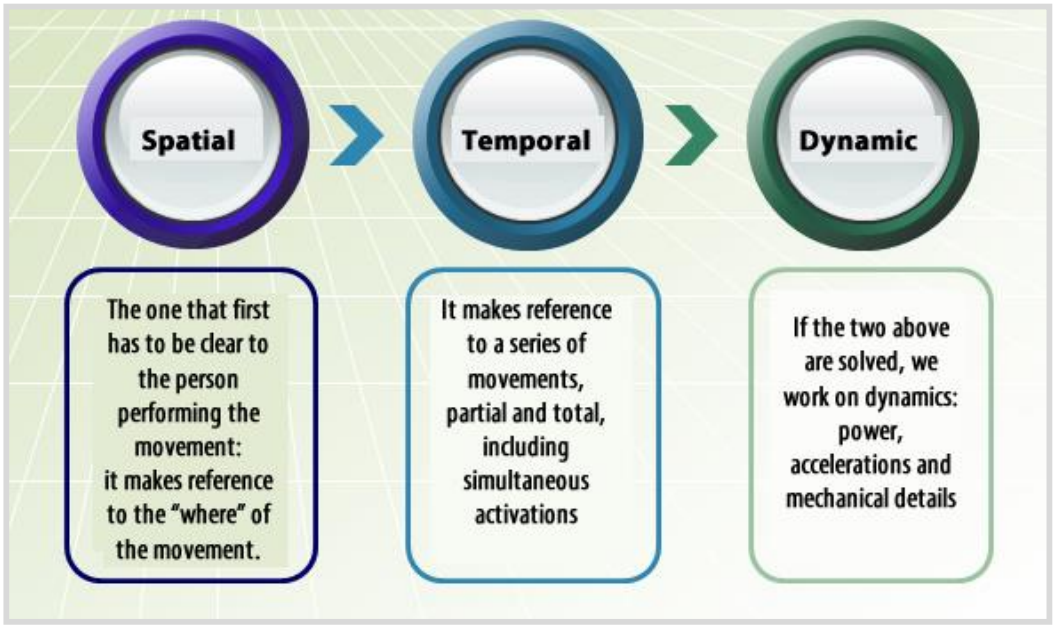
It is necessary to pause at *provide few explanations* to underscore that these should be related to the imprecise sensations that the student perceives and, at the same time, should be linked with the blurry images of movement that they are presented with. The interventions should be brief and sensory in nature, about essential issues; lectures or clinics about technique are useless at this point.

Training all of the phases should be planned, taking into account that each student is a distinct individual, and that this individual experiences a reality, a context, a trajectory, etc., which conditions their actions in the face of a given stimulus.

The above reference to individual variation in interpreting instructions is important, as not everyone understands in the same way, which often requires us to adopt specific measures for each case. This, far from being a difficulty for the teacher, should be understood as a challenge that enriches both parties.

To create a good structure of movements, we recommend following a logical sequence that favors learning:

Figure 2: Structure of movements



Source: Prepared by the author.

Before performing the movement, the spatial structure is the first that we should point out to our student, with the goal of understanding where we have to move a given limb, where we use supports, the trajectory of an arm, etc.

Once this has been internalized by our student, the next step is to know the chronological order of the partial movements that make up the structure of the movement that we want to carry out. The more complex the movement, that is, the more segments it involves and the greater the number of partial movements that it contains, the greater the difficulty it presents for our student.

Only if both have been overcome can we introduce the dynamic structure, which refers to the rhythm that the movement possesses. As a starting point, we should concentrate on the central movements of the movement, and emphasize them: "The especially intensive impulses of force and the points of acceleration or the clear deceleration phases need to be emphasized" (Grosser & Neumaier, 1986, p. 109).

2.1.3 Special teaching method in the acquisition phase

It is very important, at the moment when faced with a student who wants or needs to learn a certain particular facet of some sport or discipline, that the teacher in charge establish an action plan and develops a proposed teaching method that will allow them to reach their objectives. To create this teaching plan, the instructor should take into account various aspects: the objective, the material resources, the context, the competition dates, the student's level of training, etc.

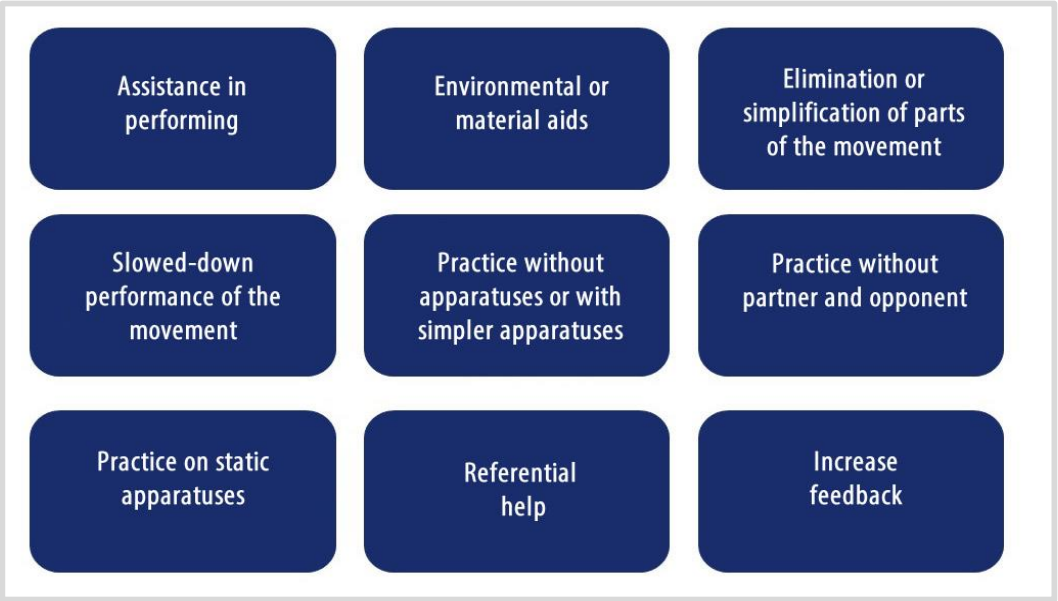
We should not, as trainers, plan in the same way for a beginner and an advanced student. It is important to understand that, in the acquisition phase, the main objective is that the movement can be fully executed, with normal errors, but in only a few attempts.

It is necessary that the practices not be too prolonged, as when faced with the first attempts, the brain does not differentiate between the correct and the incorrect, and there is a high probability of recording many mistakes.

The predominant methodological measure for the beginner in technical training is "elaborative practice" (Martin, 1977 p. 223), "under simplified conditions" (Grosser & Neumaier, 1986, p. 110).

Below, we graph the different possibilities for facilitated conditions, according to Manfred Grosser & Neumaier, 1986.

Figure 3: Facilitated conditions



Source: Prepared by the author.

Using facilitated conditions not only aids in learning the technique, but also reduces the effort involved in correcting errors. The better we do things in the learning stage of facilitated conditions, the fewer errors we will have to correct later.

Each one of the conditions mentioned above has defining characteristics:

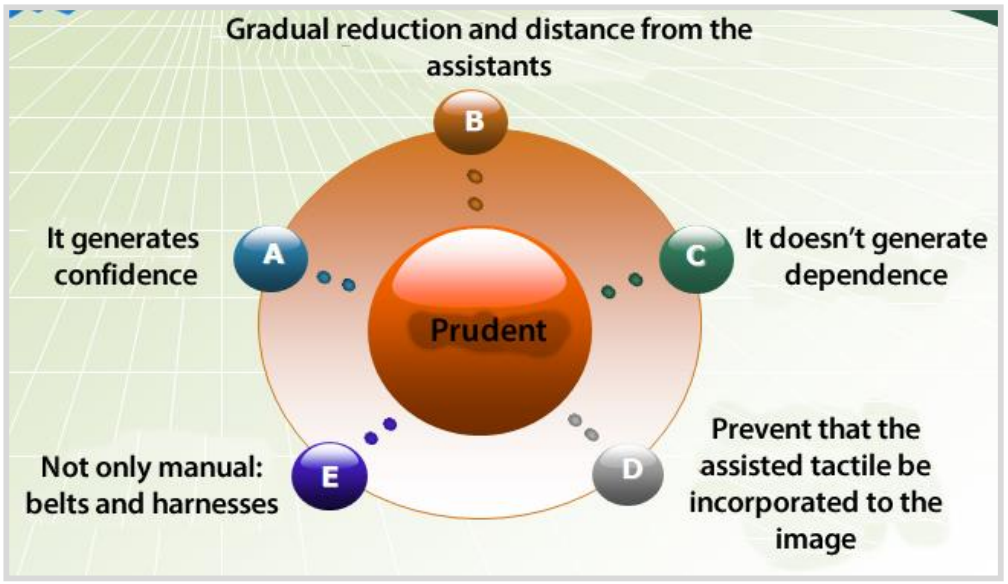
- Assistance in performing

Assistance can provide a sense of security that allows our athlete to not pay attention to the fear that a given action generates, and to concentrate on what they need to perform. Sometimes, in sports that involve risk, the first attempts are accompanied by feelings of fear, which influence the execution. The presence of a helper reduces or eliminates this fear during the attempts.

In general, during the first executions of a new motor pattern, there are often errors produced by the student's incapacity to exercise the appropriate force required by the technique they are trying to perform. In these cases, assistance is crucial so that this student can perform the entire exercise. The experiences of complete movements are highly important, as it is through them that students form images of movement and motor programs.

To create faithful images of movement for the correct motor pattern, the athlete should not be passive during the execution, but rather should, to the extent of their abilities, be active in order to generate proprioceptive feedback. Assistance can serve to accentuate key moments of the action.

Figure 4: Considerations in assistance



Source: Prepared by the author.

It is important to understand that aids should not always be present, but rather have a beginning and an end, and should serve, more than anything, to ensure that the person performing the movement will not suffer falls or injuries that could discourage or alienate them from the practice of the motor actions. It is here where we take extreme issue with the idea that gymnastics is an individual activity. On the contrary, the coaches are responsible for the safety of the subject who executes the actions and should be attentive, follow them, and be empathetic.

- Environmental or material aids

The main objective of this facilitated condition is to reduce the levels of force application or the demands of tasks that require precision. This allows our students to focus on the critical phases of the full execution, without spending so much attention on the force or the emotional blocks.

There are different measures that allow us to facilitate tasks, like belts, elastic trampolines, lower nets, bigger rings or baskets, trenches, inclined planes and other resources.

- Elimination or simplification of parts of the movement

This is an excellent technique for learning high-risk techniques, for example complex skills in gymnastic disciplines.

When we eliminate or simplify parts, we do should not necessarily start with those that first appear in the temporal structure of the movement, but rather with those that are the

most new to the subject, that is, with those perceptual ideas that have not yet been explored.

We must take into consideration that, during the acquisition phase, it is much better to multiply the possibilities with facilitated conditions and perform a few repetitions of each one than to, on the contrary, pick a few simple exercises and perform many repetitions of each one. With the first option, we favor positive transference.

When breaking down an athletic motor pattern, we should not pressure ourselves to make our student perform it in its full form. It is preferable to spend more time on facilitated learning conditions and not build up lots of repetitions with poor and erroneous overall forms. The objective is that our athlete be able to perform good executions over multiple executions, with the goal that their brain forms a motor memory with this good technique. If, on the contrary, we make our student perform complete technical motor patterns prematurely, we can commit the error of having the brain form a pattern with a motor pattern full of errors: the brain does not have the capacity to distinguish between good and bad executions.

- Slowed-down execution of the movement

This is a strategy with great didactic value. It involves a slow or ultra-slow movement. This allows us to incorporate and become aware of proprioceptive sensations that normally happen at the periphery of the subject's attention. To increase the sensations that we could become able to perceive during a movement, we can use ultra-slow executions in front of a mirror.

- Practicing without apparatus or with simpler apparatus

If it turns out to be less complicated to perform a given technical motor pattern without an apparatus or element that is used during real competition, we should eliminate its use or simply modify it in order to facilitate the executions.

In the case of sports that use elements like a ball, one could use larger or lighter balls so that the beginning student does not fail to hit the element or so that it can travel longer distances without the need to exercise high levels of force. Another example could be the use of wider bats with the goal of allowing the student to experience of correct batting technique and to feel the contact between bat and ball more easily.

In the case of sports that use fixed apparatuses, we can modify their dimensions, for example: lowering the height of gymnastics beams or lowering the height of the hoops in basketball.

- Practice without teammates or opponents

This teaching strategy allows us to structure the spatial and temporal dimensions, without the pressure that the actions of teammates or opponents can create when they are on the field of play. There are various ways to work with this facilitated condition:

1) Having our athlete move around the field of play building a tactical picture without opponents.
2) Performing technical-tactical actions while the other team "shadows", that is, they move as opponents but without actually interfering.
3) Performing "choreographies" that are used in the sport, which normally occur in groups or individually, independent from the movements of a teammate.
4) In combat sports, practicing motor patterns without an opponent or a sparring match, that is, accomplishing a specific task.

- Practicing with static apparatuses

The use of static apparatuses or elements facilitates motor learning by suppressing the need to calculate trajectories of balls or other devices. The static elements can be used to facilitate shots, hits, etc., and in other cases to mark the positions of opponents and teammates. For example: to help a beginner learn the motor pattern for shooting in soccer, it is useful to do so with a stationary ball; if we are working on dribbling (in basketball, for example), we could place cones to simulate the positions of opponents.

- Referential augmentations

This strategy involves strengthening one of the senses. Visual stimuli are most frequently applied; these help speed up configuring the spatial structure of the movement. This strategy is also highly pedagogically useful using auditory and kinesthetic stimulation.

- Increase feedback

This can be used with any of the analyzers, like the proprioceptors, the visual receptors and others (for example, auditory ones). Augmenting proprioceptive feedback implies an increase in weight or in the contact surface, demanding more force and greater stimulation. Visual stimulation can be addressed by implementing mirrors or other sources to increase visual information.

In summary, *facilitated conditions* are the combination of measures and procedures that help us overcome emotional blocks and achieve the complete form without assistance,

allowing us to move on to corrections. When implementing these measures, we can use them or combine them as we see fit.

2.1.4 Considerations for the acquisition phase

There are certain key aspects of the teaching processes that are also totally compatible with error correction processes. When teaching a new skill or correcting an already learned one, the point in the class where this content should be worked on is always at the beginning. At this point in the session, there is a higher level of attention, which strengthens the student's capacity for assimilating what we want to communicate (their information processing channels have a "fluid traffic", and are not yet over-saturated). Another important aspect is that the student does not yet feel the fatigue that accumulates over the course of a training class. These aspects have repercussions on the student's learning. Working at the beginning of the class allows them to process the content without an overstimulated nervous system, and execute it with the advantage of not being fatigued. This decreases the chances of making errors, and reduces the injury risk. As we mentioned earlier, it is better to perform fewer executions, so as not to record errors.

Figure 5: Considerations with respect to repetitions

Source: Prepared by the author.

In the acquisition phase, corrections should primarily aim to avoid big errors that could lead to falls, blows, or traumas of different kinds. The priority remains, above all else, to achieve the final complete form, in broad strokes and without assistance.

The risk that we often fall into as professionals is providing too much information that saturates the student's processing power. When working with technical executions the

most recommendable practice, from our professional experience, is to work in series, as this allows us to take advantage of the residual memories of prior executions and previous series. Therefore, it is necessary to establish the number of series and repetitions of each exercise beforehand, and educate the athlete to carefully record the technical loads in notebooks.

Free practice combined with other movements is ideal for the last stage of the process. This is just the first of three stages of learning, but there is no key moment which we can use to determine which phase of learning the student is in. Since there are no evaluations that can determine which point our students are at, we consider this stage to be completed once the student can perform the complete movement fluidly and without assistance (although some errors exist), and we can begin to use the teaching methods for the next phase.

The task of the teacher should be to show the objective in such a way that it seems accessible for their student and, if there are errors, they should try using these tools and, why not, think of and create new ones that help them to overcome this point and allow the student to restructure a correct motor engram.

Unit 2.2 Teaching method II

2.2.1 Principle traits of the refinement phase

As the name indicates, this phase is for perfecting technique. In contrast to the previous stage, we move from full execution to progressively cleaning up errors and making final adjustments to the movement, developing the correct final form.

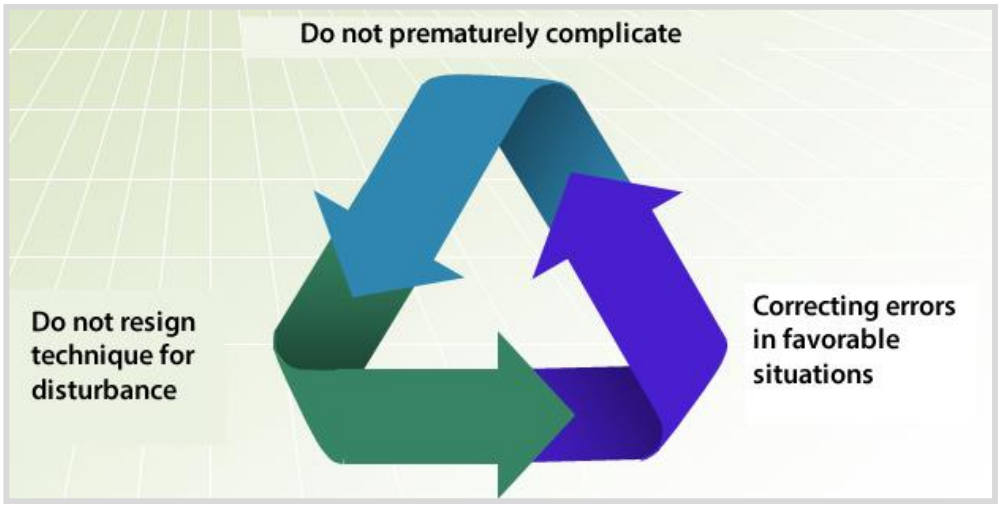
Motor practice will be based, primarily, on repetition. The process calls for repetitions using general corrective measures and other resources, without the sudden use of disturbances that do not allow us to meet the objectives.

A vitally important part of correctly learning a technique is to perfect the executions before stabilizing or automating, as it is not useful to work on the goals of the next phase before having polished the movement as much as possible. Refining prematurely can jeopardize the learning process, as it can create stagnations that are very difficult to overcome, forming a technical "ceiling". If this happens, it is important to give as much time to this student as possible; to us, failing to correct is worse than failing to teach.

The main features of the refinement phase are detailed below:

- **Capacity for performing the task:** improvement under favorable conditions, although there may be little stability under unfavorable conditions.

Figure 6: Considerations for performing the task



Source: Prepared by the author.

- **Quality of execution:** some errors can be seen clearly under unfavorable conditions. In this stage the technique is not yet stable and sometimes, even under favorable

conditions, the movement fails; nevertheless, errors are progressively eliminated through appropriate intervention.

- **Motor sensations:** with respect to this characteristic, we could say that the sensations are:
  - Precise.
  - Discriminative.
  - Conscious.
  - Verbally expressed.

  As practices and trainings go on, we can see an evolution with respect to conscious data gathering relevant to the motor execution.

- **Images of movement:** Detailed, with temporal and dynamic components. The refinement phase is the phase during which it is useful to begin to methodically train the image of movement, without forgetting that often the subjects are beginners in handling this tool. We recommend progressively measuring times and suggesting specific assignments for ideomotor training, without forgetting the priority of practice as a source of relevant kinesthetic data for the image of movement.

- **Direction and regulation:** the student is provided with precise, internal feedback, with few errors in controlled conditions, although this is not the case when faced with distractions. The proprioceptive activity begins to be more important in the regulation of movement and its contribution. In turn, there is a continuously decreasing dependence on exteroceptive analyzers, without forgetting their importance or their possibilities for correction. The coach's contributions are important, although the student is increasingly able to gather their own information that is highly useful for regulation.

2.2.2 Objectives of the refinement phase

To provide a snapshot of what makes up this phase of learning, we can see in the following table the objectives and the principle measures of motor refinement.

Table 2: Objectives and Measures of the Refinement Phase

Objectives	Measures
Refine the image of the movement. Eliminate synkinesis. Introducing resistance to disturbances. First tests in competitions.	Observation and analysis tasks. Practice under normal conditions, introducing the first disturbances. Mental training.

Source: Prepared by the author.

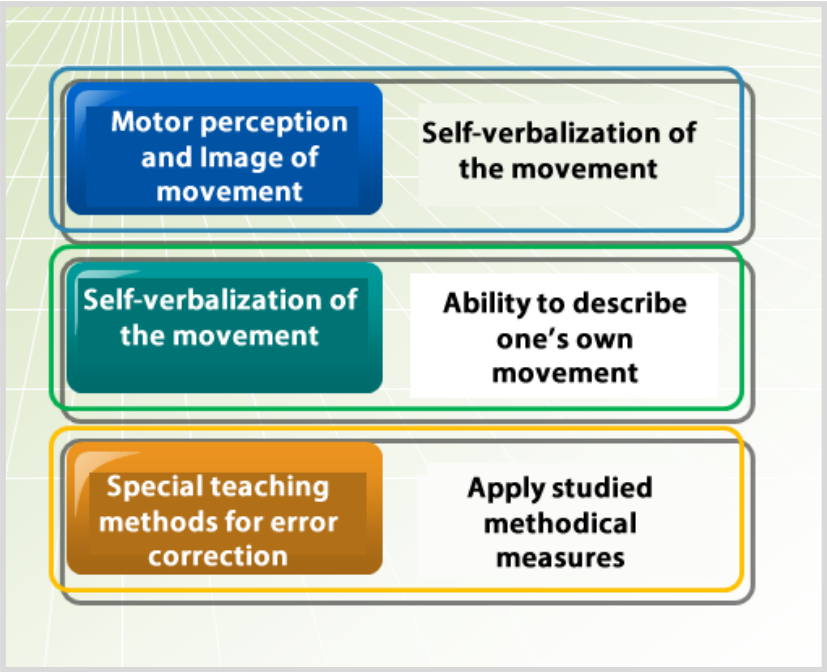
We could say that the overall objective of this phase is eliminating static and dynamic synkinesis, at the same time that we develop a clear image of movement. In the same way, we begin the process of cementing the movement when faced with disturbances, in a gradual and progressive fashion.

The best teaching methods are those that contribute to forging a clear image of movement. This stage is more "mental", in the sense that it is more viable to use resources like perceptual, ideomotor and verbal training.

The general measures that we should use to develop a correct teaching method, in our opinion, should be: apart from a good number of reps (applying what we learned in the unit **Error and Correction**, that is, without pushing during fatigued conditions, avoiding executions with errors and combining the practice with observation, analysis and ideomotor training) we should progressively introduce disturbances in such a way that they do not affect the overall structure of the motor pattern, always placing the quality of the executions over the quantity.

Just as there are general measures, we can also identify some specific measures, based on the following:

Figure 7: Special measures in teaching method II



Source: Prepared by the author.

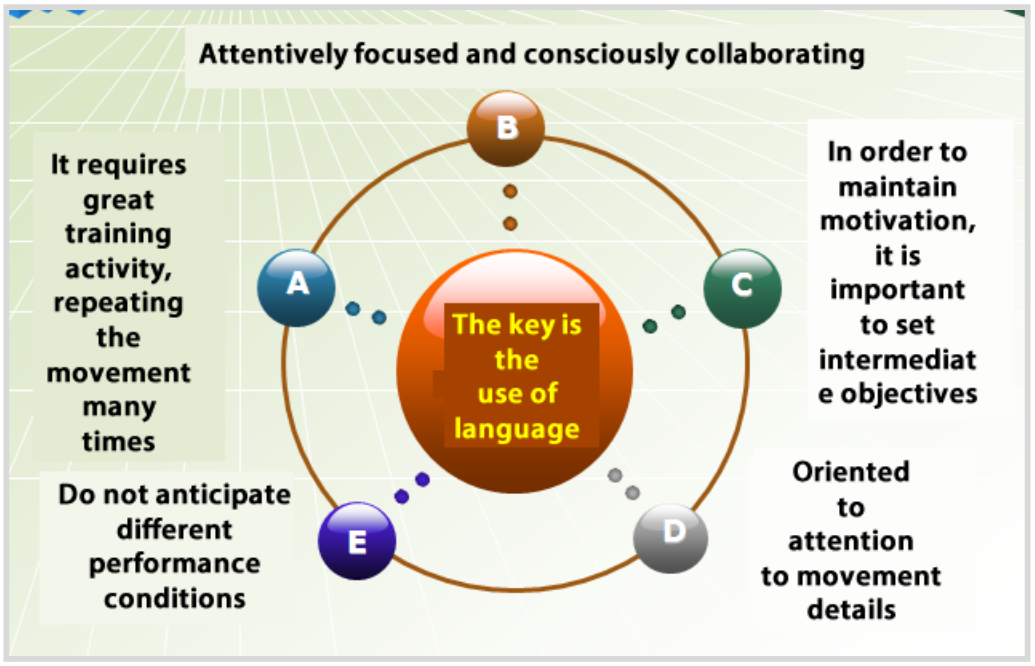
When talking about perception, the most important information is what we obtain from our visual receptors. As discussed in previous classes, visual training can be addressed with specific training plans.

The teacher should teach their student to observe what is truly relevant, so that they will direct their attention towards what is critical and ignore other events.

The image of movement can be addressed starting with ideomotor representation, which is a crucial tool for this phase of the technique training process. This can be applied as a content within a regular training session, or it can be a separate event, like a specific imagery session. It is important to ensure that the implementation of this tool does not mentally overwhelm our students. This tool should be applied with confidence and responsibility, always in an environment where there is a pleasant atmosphere which generates a positive emotional climate. The ideomotor training session should be agreed upon with our student or group of students, and should never be arbitrarily imposed by the head instructor.

When verbalization is named as a highly important measure, it is important to highlight that it is highly effective, although not widely known. Just as with the previous method, it should be applied in a positive atmosphere and with confidence; it can be used simultaneously with other tools or methods. If we decide to use verbalization, we should choose precise words, which do not draw attention away from the focus, with the goal of reinforcing the image of movement and, in turn, the motor programming.

Figure 8: Use of verbalization



Source: Prepared by the author.

2.2.3 Procedures for the refinement phase

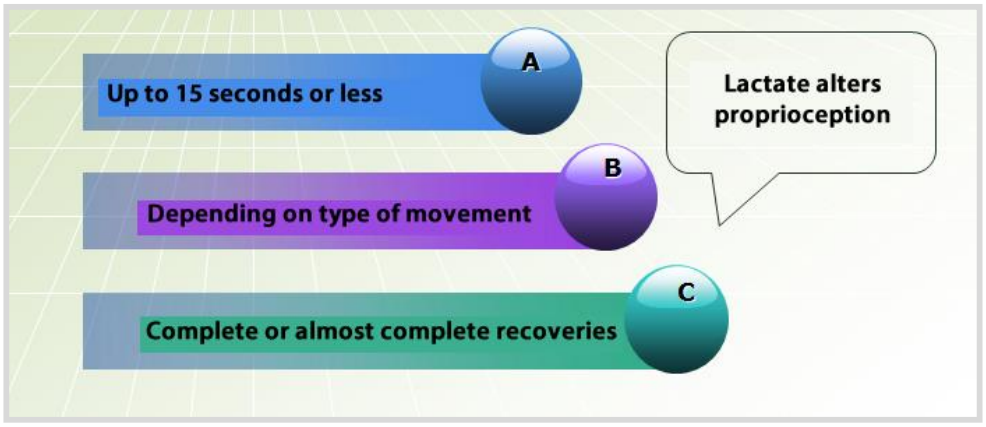
In the refinement phase, the teacher undertakes to plan activities where there is a lot of possibility for varying the exercises and the apparatuses or elements to be used. As this is the phase marked for taking advantage of the possibilities for combining exercises and elements, we should not put off taking advantage of this resource.

What we have just stated could create the impression that the goal is to propose different activities in every class, but the main goal is always to create high quality technical executions. The great number of variations and combinations can be implemented only when they do not provoke errors in the technical motor patterns.

Just as with the entire learning process, in this phase, the activities should be initially structured in series; it will not help our student at all to propose cycles that favor the appearance of errors. We can progressively move from a highly structured plan to more free and unstructured activities.

No less important is the topic of repetitions during the activities. In this aspect there is no specific number, but we can state that our student should perform all those actions that can be performed within the limits of the phosphagens system, without having lactate invade glycogenic areas.

Figure 9: On repetitions



Source: Prepared by the author.

The reason we recommend full recoveries, attempting to avoid anaerobic training, can be partially explained by the ideas of Vargas (2007). Anaerobic capacity depends on the amount of work that a person can perform within this metabolic zone. This amount of work depends on the level of glycogen stores the student has along with their capacity to tolerate lactate. Based on their experience in training and their training level, they can tolerate approximately around 20 millimoles of lactate per liter of blood. All the same, after

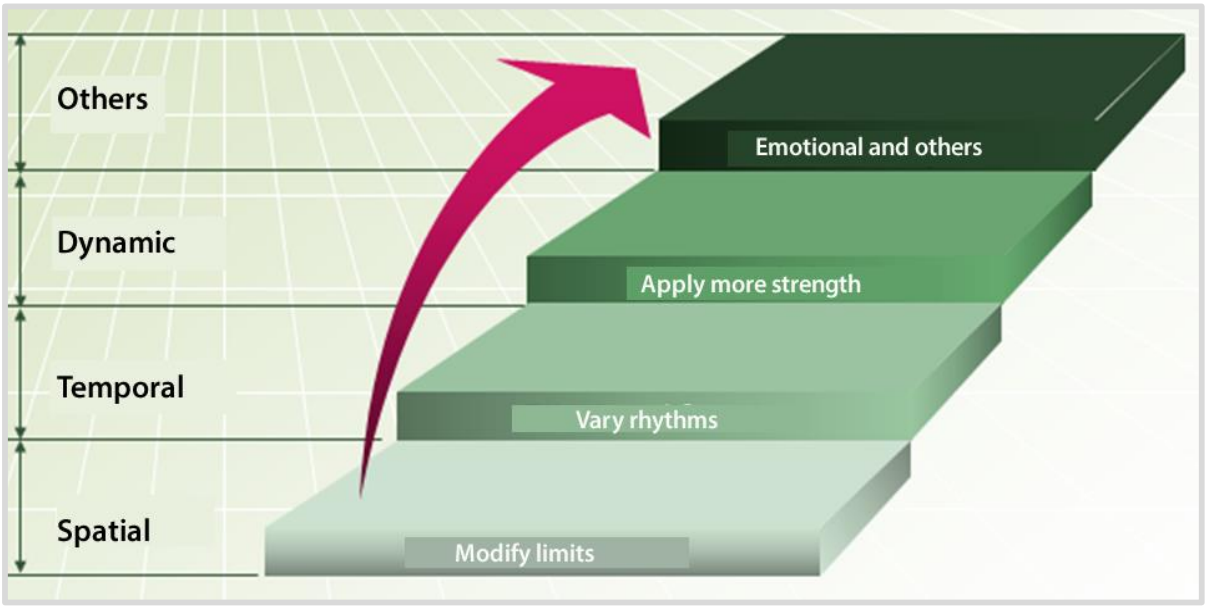
6 mmol/L of sanguineous lactate, the capacity for coordination and technical and tactical actions is disturbed.

"In light of these associated negative factors, caused by high concentrations of lactate, training for anaerobic capacity should be programmed very carefully," Hegner (as cited in Vargas, 2007, p. 40). Whenever we are working on specific technical or tactical content, or new content, it is important to know how to regulate the training loads to avoid addressing this content when fatigued.

2.2.4 Employing disturbances as a didactic resource

As a suggestion, we propose that the first disturbances that we should apply are those corresponding to the spatial order, next including temporal disturbances (complicating the sequence of actions), and progressively incorporating those related to the movement or the dynamics (whenever this does not modify the original motor pattern). We can, finally, disturb the emotional atmosphere.

Figure 10: Summary of disturbances



Source: Prepared by the author.

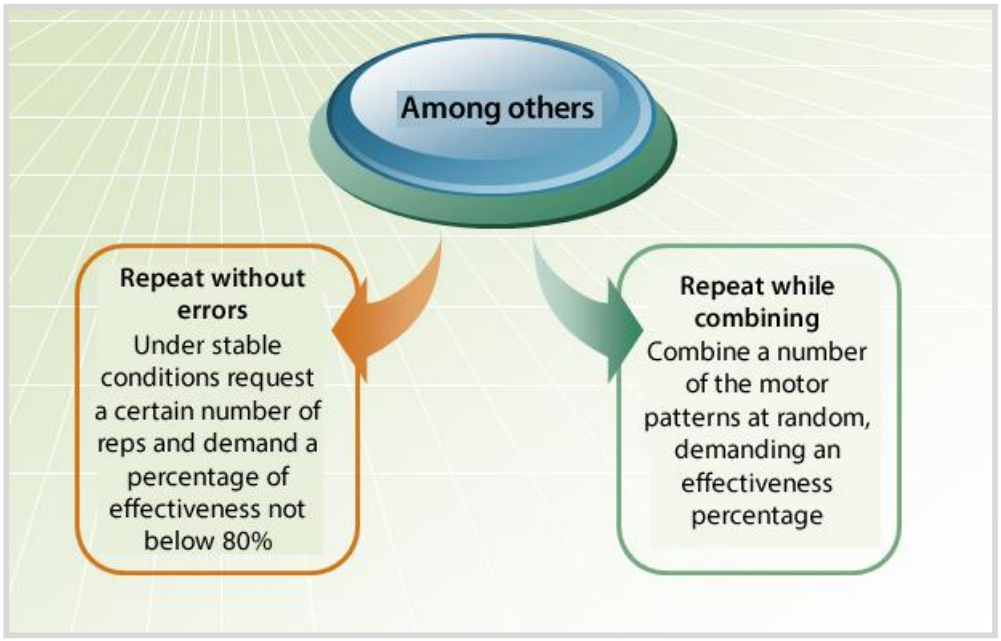
This suggested progression is drawn from our everyday practice, but the variations will depend on multiple factors. Technical quality should always govern the activity; all else is subordinate.

The objective is to perfect the technique and to correct the movement; this is why we repeat executions.

We consider it crucial to promote thought and consideration in physical and technical training, always at its proper time, avoiding falling for professional errors that lead to analysis paralysis, as studied in prior courses.

Below we provide a few ideas for evaluating technical executions, after employing disturbances.

Figure 11: Evaluation options



Source: Prepared by the author.

References

Grosser, M., & Neumaier, A. (1986). *Técnicas de entrenamiento: teoría y práctica de los deportes*. Barcelona: Martínez Roca.

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