



10 KEY POINTS

TO BE EXPLOSIVE

FREE E-BOOK

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“What am I going to learn with this Ebook?”

One of our main goals, in Karate Science Academy, is to take scientific knowledge, simple and practical, to all Karate Instructors.

To reach this ideal we produce posts, ebooks, videos, webinars, infographics and many other teaching materials, that are made with you in our mind.

In this Ebook, you are going to learn 10 Key-Points that are crucial to develop a more explosive Karate (for you and your students/athletes). First, you need to know what is each Key-Point; later, in other teaching materials, you'll know, more profoundly, how to potentiate them in a practical way.

Read all the chapters with all your attention... it's only 34 pages of pure knowledge that can open your mind and be a new way of seeing Karate!!

Our Methods

My name is Pedro Candeias and I'm the Scientific Search Coordinator from Karate Science Academy.

In Karate Science Academy we have a mission: to organize scientific knowledge and make it universal, easy and useful for every single Karate instructor or student! Fortunately, there always be more information to organize and new ways of turning it useful... and Karate Science Academy will always be here to accomplish this goal.

As a Sports Trainer, I always felt the necessity of **looking for answers to the thousands of doubts** I had in my mind about the **best and safest ways of training human people**. I became an Education Courses "addict" and after starting my Master of Science in Sports Training I became a Scientific Articles/Papers "addict" too. **I'm**

going to tell you a secret: my bedside table readings before sleeping are Scientific Reviews, Articles, Books... all about Human Movement, Sports and Health. And I'm pretty sure there are thousands and thousands of Karate Trainers that feel the same...

We have a huge database with thousands of Scientific Articles, Books and Vídeos from where we take useful and practical knowledge to help all Karate teachers and athletes/students train in a **more effective, safe and motivated way**. And every day we attach more knowledge to our database: because SCIENCE DON'T STOP and is giving us new tools to improve our life, every single day!!!

WE PROMISE YOU ONE THING: WE WON'T GIVE YOU OPINIONS; WE'RE GOING TO GIVE YOU SCIENTIFIC-EVIDENCE FACTS!!!



Join us on this Road ("Do" in Karate-do means "the way to always become better";
better Karateca and better Sensei – don't you never forget this)

Pedro Candeias

(Scientific Search Coordinator of Karate Science Academy)

Introduction

After all, what is SCIENCE?!?

Some people looks to Science as a nerdy thing, with lack of connection with "real world"... complicated language, complicated methods, etc, etc.

That's a terribly wrong idea, that kept people away from Science!!

Science is the effort to understand how human body, nature and many other areas work! **It's a set of knowledge that comes from practice and experimentation.**

Science it's not theory... because theory without practice is Philosophy, not Science! In Science, theory comes from practice and objective investigation, not

from someones personal opinion... To be considered Science, a new knowledge it's tested several times, by several and independent investigation teams that seek for answers.

Engrave this sentence in your brain:

"A professional (in your case, a Karate instructor) who doesn't give value to scientific knowledge is necessarily a poor professional"

In Karate Science Academy we know that it's too difficult to follow the crazy fast rhythm of new knowledge, it's too expensive to get all the education that keeps you in pace of that knowledge and even that scientific community uses, too much times, a complicated language that seems far from reality...

But Karate Science Academy was created to overcome this real problems!

Stay tuned and become an expert.

Scientific Content

10 KEY POINTS TO BE EXPLOSIVE

Power

Many sports require the ability to generate high amounts of force in relatively short periods of time – in Karate, this is transformed in “speed”.

The ability to express high rates of force development is often related to an athlete’s overall strength levels and ability to express high power outputs. Stone et al. suggested that the ability to express high rates of force development and high power outputs are critical performance characteristics central to success in most sporting events – and everyone can see that this is totally true in Karate. These abilities are considered to be among the most important sports performance characteristics, especially in activities that rely on jumping, change of direction, body

displacement and/or acceleration performance, as Karate.

The overall relationship between sport specific movements and the ability to generate high power outputs is well documented in the scientific literature. In many sports,

it’s scientifically identified the difference of power between elite and non-elite athletes or between starters and more experienced participants.

Based upon the contemporary scientific knowledge, it is evident that maximal strength, the rate of force development (i.e. “explosive strength”), and peak power generating capacity are all important attributes that need to be developed when implementing Karate strength and conditioning programs.

There is a considerable debate about which of these characteristics should be the primary training targets when attempting to optimize power output with resistance training interventions. It is often believed that as the external load diminishes the influence of maximal strength decreases and a greater reliance on the rate of force development occurs. And this tell us so much about the best ways of training for a more explosive Karate...

This takes us to what it’s called “The Optimal Load” for training!!!

Should a Karateca practice with more heavy loads or it’s better to train with light or moderate external loads, when he wants to become more “explosive”?!?

(This is a topic to discuss later, on other teaching materials)

3 Fundamental Power

ELEMENTS

First, it is essential that overall muscular strength is maximized because of its direct relationship with the ability to express high rates of force development (i.e. “explosive strength”) and power outputs.

Second, it is important to develop the ability to express high forces in very short periods of time, which are reflected by the rate of force development.

Finally, it is important to develop the ability to express high forces as the velocity of shortening increases (as a throwing technique or a Karate strike with full contact, for exemple).

There is a strong interplay between each one of these Key Elements with overall strength levels serving as the main driver for the ability to express high power outputs. Support for the interrelationship between maximal strength, the rate of force development, and maximal power output is clearly seen in the scientific literature where significant correlations have been found between these variables.

The ability to generate maximal power in dynamic, multi-joint movements is dependent on the nature of the movement involved. Therefore, the exercises selected for a Karate power training programme may influence the magnitude of performance improvements and type of adaptations observed.

You can improve Power with training types as:

- # Traditional Resistance Training Exercises
- # Ballistic Exercises
- # Plyometrics
- # Weightlifting Exercises

The ability to generate maximal power during sports-specific movements depends on the load applied to that movements:

- # Heavy Loads
- # Light Loads
- # Combined Loads
- # "Optimal Load"

What is MECHANICAL POWER?

Mechanical power is the rate of doing work (this kind of more scientific terms will be well explained in our future Science Dictionary) and **is calculated by multiplying force by velocity**. There is a basic inverse relationship between the force a muscle can generate and the velocity at which it contracts: the amount of force that can be generated by a concentric muscle action decreases as the velocity of movement increases (**more velocity = less force**).

When we talk about the maximal power output a Karateca can produce, it is evident that force and velocity are interdependent and that maximal power output occurs at optimal levels of maximal force and velocity. And we have differences between a punch or kick and a throw, where we must move the opponents body weight!!

Rate of Force Development

Rate of Force Development it's, typically, what we know as “Explosive Strength”. “Explosive strength (let's call it like that, because we want clear, simple and practical knowledge) is the ability to increase force as quickly as possible during a rapid voluntary contraction executed from a low or resting level.

“Explosive Strength” it's better related to most athletic performance – including Karate – and functional daily tasks (and this is so, so important for Karate Trainers, because all of the students that train Karate

only for health, leisure or self-defense) than pure maximal voluntary contraction (MVC) strength of each person.

Contraction times of 50–250 milliseconds are associated with fast movements such as jumping, sprinting, or changing of direction (as well as punching, kicking and body displacement, typical of Karate). In these situations, the short contraction times make it unlikely that maximal forces can be applied, because it can take 300 milliseconds to generate maximal force.

“Explosive strength” seems to be governed by different physiological mechanisms. **A better knowledge of these critical aspects is vital to**

designing Karate training sessions not only to increase explosive force production in your students and athletes but also to improve physical function and reduce injury in all kinds of students, independently of their age, gender or objectives. This requires the ability to produce a rapid rise in contractile force during the initial phase of a voluntary contraction (0-300 ms). We can call it initial acceleration phase...

“Explosive Strength” (Rate of Force Development) is determined by Neural Factors, as motor unit recruitment and firing rate, as **also by Muscular Factors**, as muscle fiber type muscle size and architecture, musculotendinous stiffness and myofibrillar mechanisms

Although scientific observations support that neural adaptations are a strong contributor to the gain in “Explosive Strength” induced by training, additional contributions also occurs from increases in muscle

size, type II muscle fibre proportion and tendon stiffness characteristics.

Increasing overall anatomical muscle size (cross-sectional area or volume) with training represents an effective mean to increase “Explosive Strength”, since maximal contractile force capacity (and thereby RFD) is strongly governed by the size of the muscle. **But in Karate, specially in Sports Karate (with or without contact), you must be careful with the raise of muscle size (hipertrophy) because of the weight categories: you want your athletes to be as most explosive as they can, but in their weight category!**

Preferential type II hypertrophy is expected to increase “Explosive Strength” to an even greater extent, because type II fibres have higher intrinsic “explosive” potential than type I fibres. But it’s important to have in mind that non-selective muscular fibre hypertrophy also contributes to increased “explosive strength” by increasing MVC strength. But this is more common in less-trained participants.

“Explosive strength” can be influenced by a number of factors. For example, rapid muscle activation through **reductions in motor-unit recruitment thresholds and increases in motor-unit firing rates at the onset of contraction appear to be major factors influencing “explosive strength”**; this is particularly true in the early (first 50–75 ms) phase of a maximal voluntary contraction.

The ability to activate the muscle rapidly is influenced by factors at both supraspinal and spinal levels.

It is clear that heavy load resistance exercise results in an increase in the “explosive strength” in weaker and untrained individuals. But despite heavy resistance training can increase the athlete’s strength reserve and positively impact the “explosive strength”, it is likely that **with stronger more experienced athletes, the optimization of the rate of force development and subsequent power development is better achieved with the incorporation of explosive or ballistic exercises**. As you can see various training goals have the potential to impact different parts of the force-time and force-velocity relations.

Maximal Strength

A fundamental relationship exists between strength and power, **which dictates that an individual cannot possess a high level of power without first being relatively strong.** This assertion is supported by the robust relationship that exists between maximal strength and maximal power production as well as countless empirical observations of the differences in strength and power capabilities between elite and sub-elite athletes.

Stronger individuals possess favourable neuromuscular

characteristics that form the basis for superior maximal power production.

Strength should be considered one of the foundational elements required for the development of power. Stronger athletes are able to express higher power outputs. One explanation for this relationship relates to the fact that stronger individuals are able to generate forces significantly faster than their weaker counterparts.

Once athletes have established adequate strength levels, they are then able to maximize the benefits of incorporating specific training activities (i.e., plyometrics, ballistic exercises, and complex or contrast training). Stronger athletes generally

demonstrate a greater responsiveness to targeted power-based training methods such as plyometric or explosive exercise training.

The maximization of muscular strength is a key component of all Karate training programs that are designed to maximize power development capacity (in athletes is mandatory, but when possible it's also important in non-athletes students – if your Dojo has a gym, for example)

The relationship between maximal strength and power should always be considered when designing performance-based resistance training programs in Karate. **The development of maximal strength should never be neglected** and should always be part of the training process because maximal strength is the critical quality that underpins the ability to develop high power outputs in a variety of sporting movements.

But don't be scared: When we talk about Strong Athletes, we're not talking about "Slow and Rigid Inflated Guys"!!

Reactive Strength

Karate (and great majority of sports) isn't based on pure and isolated muscular actions. Reactive Strength manifests itself on Stretch-Shortening Muscular Cycle. And what the hell is this?!?

Stretch-Shortening Cycle (SSC) involves 3 phases:

#Pre-Activation

#Stretch

#Shortening

When we make multiple sequential leg movements, as Karate displacement combinations, jumps, hops or another forms or human locomotion (walking or running), a considerable impact occurs on the tatami or the ground. This phenomenon leads to a pre-activation, before ground contact, to prepare the musculotendinous complex to impact; this leads to a stretching load, followed by a shortening phase (concentric action) of the same muscles.

When properly done, SSC can utilize elastic energy for improve your Karate performance.

This event can also be seen in upper limbs. In cases of clap push-ups, with ground contact; but we can see it too in actions with countermovements, like a rapid preparation of a Tennis serve – we can comprove this in some Kata attacks where we rapidly pull the arm before the main action (we really feel more power and Kime)!!

The most known types of exercices to develop Reactive Strenght are Plyometrics...

(This topic will be developed more deeper in a series of emails, that we'll send you for free in the next days!)

Agility

How many of you know how to answer, without hesitation, if someone asks you what really means Agility?!?

This is one of the most misunderstood concepts in the world of sport!!! Please, retain what Agility really means, because is one of the most important things in Karate fight (call it Shiai Kumite, Jiyu Kumite, Randori, or ever you want). Every free Karate fights are hugely determined by Agility and his main components, as perception or decision-making; conditioned fighting exercises that include random/aleatory stimulus also stimulate and requires agility. On the contrary, closed and fully combined exercises (for example, most of Bunkai) are not

included in the definition of Agility, because are totally pre-planned!

Agility is a rapid whole body movement with change of velocity or direction in response to a stimulus (random/aleatory).

As an example, we have a change of direction or speed of movement in reaction to an opponent's attack(that is not previously determined).

Karate Kumite is characterized as being intermittent in nature, whereby fighters/participants are required to frequently transit between brief bouts of high-intensity movements and periods of low-intensity activity. In addition, karatecas may perform movements such as kicking, punching, blocking, throwing, linear displacement and directional changes integrated with technical skills.

Agility must be declared as a fundamental quality

required by Karate participantes, if they really want to know how to fight: either in a sports context or self-defence scenario. Surprisingly, we continue to see most of Karate teachers focusing their training and classes mostly on pre-planned actions, as Kihon, Bunkai, pre-planned fighting drills, etc.

Is this important for being a decent

Karateca? Yes, of course... but **if**

you want your students to know how to fight decently,

you must incorporate much more open exercises to improve their Agility!

We all know that in a totally no-rules scenario and with a non-cooperative partner, physical and technical skills are important, but correct decision-making or timing are even more important... we all know stories of Black Belts that are beaten up in the streets by smaller and even weaker guys who punch with a White Belt technique: what's the main explanation for this?

Agility depends, mostly, on perceptual and cognitive components, as correct opponent's movement perception, decision-making speed and timing, accuracy and also of technical and physical factors.

The direction of Karate training is too much focused on the physical aspects of "speed"... **it's fundamental that the pathway changes to include much more perceptual and cognitive open exercises as soon as possible (starting with little kids).**

Just for curiosity, Agility is also known as quickness or "reactivness".

Change of Direction Speed

First of all, all Karate teachers need to know that CODS it's not the same as Agility!! Performing a pre-determined Zig-Zag circuit or obstacle circuit with several changes of direction is not Agility; is Change Of Direction Speed (CODS)!!! CODS may even influence Agility performance, but it's just a small portion of this fundamental ability for Karate.

CODS can be described as a movement where no immediate reaction to a stimulus is required, thus the direction change is pre-planned - fast direction-changes in Kata are influenced by CODS.

Given the proposed importance of

CODS ability in sporting performance, it would seem beneficial for strength and conditioning practitioners to identify those training techniques that may best optimize CODS performance.

Sheppard and Young have described a number of factors that are considered important in determining CODS ability and include technical, speed and leg muscle qualities. Is this true? Science can answer this question, helping Karate trainers to understand the best training methods to improve their students or athletes performance (later Karate Science Academy will provide

you all the details about CODS training). **You need to know that the majority of training methods commonly utilized by Karate and many other sports trainers have failed to improve CODS...?!?!**

CODS movements occur in the vertical-horizontal and/or lateral direction, and require anteriorposterior (breaking and propulsive) and mediolateral force production.

Perceptual-Cognitive Skills

Perceptual-cognitive skills refer to the ability to identify and acquire environmental information for integration with existing knowledge such that appropriate responses can be selected and executed.

Knowing where and when to look is crucial for successful Karate performance, for example. But many times Karatekas, in a fight, have uncontrolled emotions (more frequent in less experienced karatekas) and are often saturated with information both relevant and irrelevant to the task. Karate performers must be able to identify

the most information-rich areas of the situation, direct their attention appropriately, and extract meaning from these areas efficiently and effectively.

Experts possess extensive knowledge that enables them to extrapolate important information from the environment to anticipate and predict future events. Experts are typically more proficient at making decisions and possess an unparalleled ability to predict future events (in a fight; we're not talking about fortune tellers) and opponent's movements.

Perceptual-cognitive skills include response accuracy, response time, number of fixations or fixation duration (fixation is where Karate experts fix

they look).

For example, **response accuracy** represents the participant's capacity of producing appropriate responses according to objective standards (**kicking or punching with the correct technique**) and in accord with environmental constraints and task demands (**control of the correct distance to head kicking with the demanded control, being almost in the "jogai" area**).

Response time is defined as the elapsed time between stimulus onset and the consequent production of a response (**we're talking about reaction time in a defense against a**

punch).

The current status of the perceptual-cognitive expertise literature suggests that the perceptual strategies and corresponding decision-making processes of experts and nonexperts is task dependent. For example, the contextual demands of defending a Karate kick requires different information-processing strategies when compared with catching a ball with the hands.

Having a quick response time reacting to a light it's not the same thing as reacting to a Karate punch. There are several studies showing that there is no difference between sport's experts and non-athletes in response time to general stimulus, but there is a huge difference when they have to react in a specific sport context, as a tennis court, responding to a real ball. The athlete's response time and accuracy are really, really better than non-athletes.

Technique

Technique is one of the fundamental dimensions of “Explosive Karate”.

Factors as foot placement, adjustment of strides to accelerate or decelerate, body control and posture. Karatecas can execute any technique more effectively by ensuring the body is in the best possible position to produce, reduce, transfer and stabilize both internal and external forces. If any segment of the body is out of the correct position or trajectory, Karate athletes and participants will not be able to achieve optimal explosive performance.

Proper technique allows to produce, among many other things, the needed propulsive forces to great Kata and Kumite.!

For example, technique has been suggested to play a key role in performance of sprints with directional changes.

In particular, utilizing low Center of Gravity (CG) appears to be essential in

optimising acceleration and deceleration, as well as increasing stability. **The stability afforded by a low CG, as opposed to the upright stance and high CG, would allow for more rapid changes of direction.** In order to change direction at higher speeds, athletes must first decelerate and lower their CG in sports that require frequent changes of direction, as Karate - should displace with a lower CG and perhaps shorter stride lengths. **The lower CG, and shorter strides are suitable for situations where changes of direction or physical contact are probable, because guarantees better chances of maintaining balance.**

Evaluation

Evaluation of the several dimensions of an Explosive Karate is fundamental to screen your students and athletes

improvements! **This way, you can adapt your training plans and give the best exercises and methods to your group...**

Science give us some methods to assess power, reactive strength, explosiveness, maximal strength, etc. Tests like Vertical or Horizontal Jump, Medicine Ball Throw, Lateral Jumps, 5 or 10m sprints (that gives a certain capacity to evaluate acceleration speed), Sidesteps, 3 Directional Jump

Test and many others.

And we're just talking about tests that can be easily used in a common Dojo with simple and cheap equipment... All this methods are reliable and validated by scientific research! We're not talking about "the ultimate fashion test" invented in some illuminated head that only wants to sell novelty to Karate or sports trainers that don't know where to find the knowledge they need...

Periodization

(we left this chapter to the end, because it's very important that each Karate Trainer that reads this knowledge imprint it deeply in his brain – and science teach us, that we remember better the first and the last things on a lista)

Training periodization has been long used by athletes and coaches in an attempt to maximize fitness gains and physical performance. More recently, even fitness enthusiasts and personal trainers have also begun to utilize periodized training plans. **I ask me why most of Karate Trainers continue to organize their classes in a total random way, without method and logical sequency of exercises and objectives!!**

Periodization is the logical systematic structuring of training interventions in a sequential and integrative way to develop key attributes that results in the

optimization of sports performance capacity at predetermined time points. It is essential that the training program has structured variation that is designed to manage fatigue while stimulating physiological and psychological adaptations. **If variation is illogical, excessive, or unplanned, the overall effectiveness of the training plan will be limited and there will be an increased risk of injury or overtraining responses.**

The correct training organization in each session, week after week or month after month **is** fundamental not only to improve Karate students and athletes performance, but also their motivation and desire of returning on the next class!!

On a Periodization model, you must take in consideration the balance between biological, social, emotional and cognitive aspects of your students and athletes. You must guarantee a close relation between conditioning and coordination abilities; between training stimulus and recovery (inside each class or among several classes).

Another **fundamental aspect is the level and age of your groups**: this is going to have a huge influence in the choice of Periodization methods!!
And is not the same thing training an athlete/small group of athletes or

recreational Karate participants: the level of individualization is totally different – with a recreational Karate class you'll choose a more general Periodization strategy, that fits on the majority of your students, but when you're training high-goal athletes you can't give them the best training sessions without a more individualized Periodization planning.

Two major types of Periodized training have received the most attention from the sport science, coaching and fitness enthusiast communities: a) classic, linear or traditional strength/power periodization and b) nonlinear periodization.

Nowadays, there are several types of Periodization:

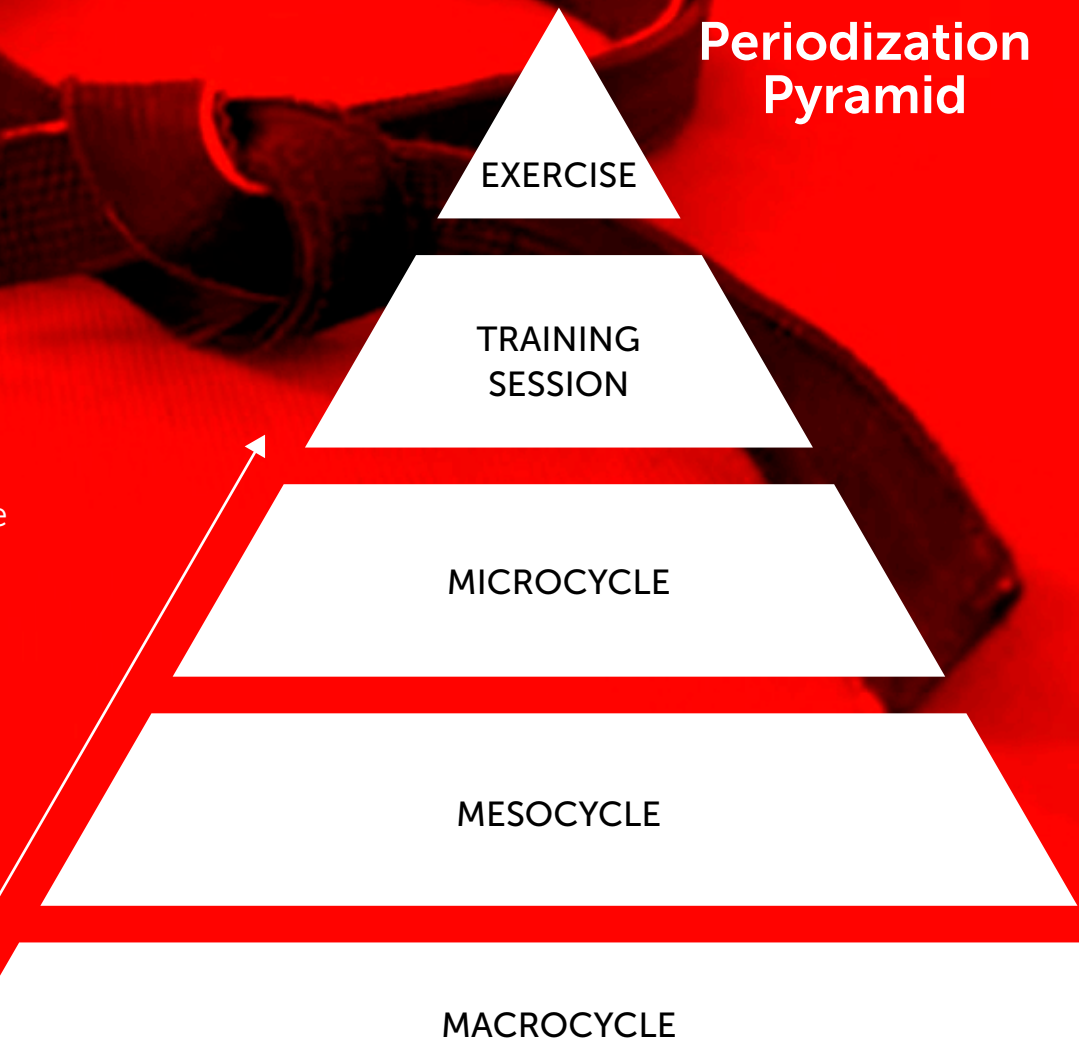
#1 **Classic Model of Matveyev**, where you divide a season in different periods: General Preparation Period, Specific Preparation Period, Competitive Period, Transition Period, etc.

#2 **Block Periodization of Verkhoshansky**, that consists in dividing a macrocycle in 3 blocks (this is mainly used in strength training and high-performance athletes)

#3 **High-Performance Periodization of Tshiene**, that is based on specific high-intensity training sessions during the majority of a season, but including a few profilitic intervals (active or passive) trying to get a supercompensation

#4 **Flexible Non-Linear Periodization (Fleck, 2011)**, based on the premise that athletes should perform some tests prior to each training session, so the coach can adapt the content of those sessions to individual daily state of those athletes.

Periodization Pyramid



There is no doubt that
Periodized training provides
statistically superior
performance improvements
when compared to
non-periodized programs

(for example, constant-repetitions, intensities, volumes or exercises organizations).

Today's scientific evidence suggests that variation is a necessary component of effective training planning.

Elevated training monotony
leads to increased incidence of
dropout, poor performance, and
even frequency of banal infections or overtraining
syndromes.

But it's important to have this in mind:

Training variation is a critical component of longterm planning, *but* if adaptive stimulus and Karatecas energy are too widely distributed, gains may be too weak.

Repetitive application of the same training stimulus may induce rapid improvements in a limited range of targets, *but* if such concentrated focus is too prolonged the athlete will be exposed to the negative effects of monotony.

When we talk specifically about elite or sub-elite athletes scientific-evidence supports extensive interindividual variation among them. And when we are talking about these levels of performance, we must take in consideration the next critical aspects:

Individual athletes will respond differently, to one another, to identical training sessions.

Identical sessions performed by an individual will always

elicit a unique training response, for that athlete

Group-based patterns and observations may be highly misleading when generalized to individuals (this is a practical way of planning classes to kids or recreational Karate participants, but not for high-performance athletes)

(IN KARATE SCIENCE ACADEMY WE'RE GOING TO PROPOSE YOU PRACTICAL WAYS OF MANAGING YOUR TRAINING ORGANIZATION, WHETHER YOU GIVE CLASSES TO KIDS, RECREACIONAL KARATECAS OR SPORTS KARATE ATHLETES)

According to Kiely (2012), we can find 2 logical fallacies evident in the periodization literature:

The assumption that averaged group-based trends and means accurately reflect individual responses;

The assumption that planning methodologies of celebrated high achievers

(in Karate, like Aghayev or Valdesi)—by definition extreme outliers—can be generalized and extrapolated to other elite individuals.

Imitate training plans from Sandra Sanchez, Luca Valdesi, Sara Cardin or Rafael Aghayev will not transform you or your students in them...

you can take ideas from their training (you can easily find it on

Youtube), but you need to know how to integrate them on your groups and athletes characteristics.

Independently of your group or athletes characteristics, **you should mark in your brain that “deviation from the preplanned path is desirable, should be actively sought, and the training management system designed to facilitate, rather than suppress, consistent modulation” (Kiely, 2012).** An effective training process depends on a crucial component: the systematic capture and review of pertinent data that are then employed to drive future direction of your training sessions. Most elite coaches already integrate aspects of this approach in their practical work (José Mourinho defends it since always, and the results are well known)!!

Flexibility should become a “Basic Rule” of Periodization for all Karate Trainers.

But a well-fundamented flexibility!!

Conclusion

Scientific Knowledge is a powerful “weapon” that will differentiate you from most of Karate teachers, all over the World! It will contribute to improve your practice and teaching, helping you to take your Karate to the next level. It will teach you new methods and allow you to improve what you already do in your Dojo.

Connected to your passion, scientific Knowledge it's the missing mark that will lead you to more motivated and healthier students.

Before you start your road to be an expert, don't forget that teaching Karate should be a personal commitment to give real and relevant value to your classes, community and your family!

Without that commitment, you'll only have a boring and expensive (of time and money) hobby...

Make the Difference!!

Pedro Candeias

(Scientific Search Coordinator of Karate Science Academy)

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